Curriculum Book

and

Assessment and Evaluation Scheme

based on

Outcome Based Education (OBE)

in

Bachelor of Technology

(Food Technology)

4 Year Degree Program

Revised as on 01 August 2023 Applicable w.e.f. Academic Session 2023-24

AKS University

Satna 485001, Madhya Pradesh, India

Faculty of Agriculture Science and Technology
Department of Agriculture Engineering and Food Technology

AKS University

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum & Syllabus of B.Tech. (Food Technology) program

(Revised as on 01 August 2023)

CONTENTS

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Forwarding

I am thrilled to observe the updated curriculum of the Department of Agriculture Engineering and Food Technology for B.Tech (Food Technology) Program, which seamlessly integrates the most recent technological advancements and adheres to the guidelines set forth by AICTE. The revised curriculum also thoughtfully incorporates the directives of NEP-2020 and the Sustainable Development Goals.

The alignment of course outcomes (COs), Program Outcome (POs) and Program specific outcomes (PSOs) has been intricately executed, aligning perfectly with the requisites of NEP-2020 and NAAC standards. I hold the belief thatthis revised syllabus will significantly enhance the skills and employability of our students.

With immense satisfaction, I hereby present the revised curriculum for the B. Tech. in Food Technology program for implementation in the upcoming session.

Er. Anant Soni
Pro Chancellor & Chairman
AKS University, Satna

01 August 2023

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
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From the Desk of the Vice-Chancellor

AKS University is currently undergoing a process to revamp its curriculum into an outcome-based approach, with the aim of enhancing the teaching and learning process. The foundation of quality of quality education lies in the implementation of a curriculum that aligns with both societal and industrial needs, focusing on relevant outcomes. This entails dedicated and inspired faculty members, as well as impactful industry internships.Hence, it is of utmost importance to begin this endeavor by crafting an outcome-based curriculum in collaboration with academia and industry experts. This curriculum design should be informed by the latest technological advancements, market demands, the guidelines outlined in the National Education Policy (NEP) of 2020 and sustainable goals. I'm delighted to learn that the revised curriculum has been meticulously crafted by Department of Agriculture Engineering and Food Technology, in consultation with an array of experts from the Food industry, research institutes and academia. This curriculum effectively integrates the principles outlined in the NEP-2020 guidelines, as well as sustainable goals. It also adeptly incorporates the latest advancements in food processing technology.

Furthermore, the curriculum takes into account the specific needs of the Indian Food & dairy industries, focusing on the production of cost-effective, high-quality processed food & dairy products. It extends its reach to optimizing power consumption by including insights on waste heat recovery systems utilized in food & dairy plants. This inclusion not only imparts knowledge but also encourages students' independent thinking for potential enhancements in this area.

The curriculum goes beyond theoretical learning and embraces practical applications by incorporating the utilization of industrial and domestic waste in food production. To enhance students' skills, the curriculum integrates Hands- On Training, industrial visits, and On-Job Training experiences, research and progress. This well-rounded approach ensures that students receive a comprehensive education, fostering their skill development and preparing

them for success in the food & dairy industries.

I am confident that the updated curriculum for food technology will not only enhance students' technical skills but also contribute significantly to their employability. During the process of revising the curriculum, I am pleased to observe that the Department of Agriculture Engineering and Food Technology has diligently adhered to the guidelines provided by the ICAR, New Delhi. Additionally, they have maintained a total credit requirement of 187 for the B. Tech (Food Technology) program.

It's worth noting that curriculum revision is an ongoing and dynamic process, designed to address the continuous evolution of technological advancements and both local and global concerns. This ensures that the curriculum remains responsive and attuned to the changing landscape of education and industry.

AKS University, Satna warmly invites input and suggestions from industry experts and technocrats and Alumni students to enhance the curriculum and make it more student-centered. Your valuable insights will greatly contribute to shaping an education that best serves the needs and aspirations of our students.

Professor B. A. Chopade
Vice- Chancellor
AKS University, Satna
01 August 2023

Preface

As part of our commitment to ongoing enhancement, the Department of Agriculture Engineering and Food Technology consistently reviews and updates its B.Tech. (Food Technology) program curriculum every three years. Through this process, we ensure that the curriculum remains aligned with the latest technological advancements, as well as local and global industrial and social demands.

During this procedure, the existing curriculum for the B.Tech. (Food Technology) Program undergoes evaluation by a panel of technocrats, industry specialists, and academics. Following meticulous scrutiny, the revised curriculum has been formulated and is set to be implemented starting from August 01, 2023. This implementation is contingent upon the endorsement of the curriculum by the University's Board of Studies and Governing Body.

This curriculum closely adheres to the ICAR model syllabus distributed in May 2023. It seamlessly integrates the guidelines set forth by the Ministry of Higher Education, Government of India, through NEP- 2020, as well as the principles of Sustainable Development Goals. In order to foster the holistic skill development of students, a range of practical activities, including Hands-On Training, Industrial Visits, Project planning and execution, Report Writing, Seminars, and Industrial On-Job Training, have been incorporated. Furthermore, in alignment with ICAR's directives, the total credit allocation for the B. Tech. (Food Technology) program is capped at 187 credits.

This curriculum is enriched with course components in alignment with AICTE guidelines, encompassing various disciplines(Total 191 Credit) such as Basic Science Concepts: 17 credits, Engineering Science: 18 credits, Humanities and Social Sciences: 10 credits, Core Program Courses: 98 credits, Elective Program Courses: 3 credits, Open Electives: 0 credits, Research Project: 15 credits, Industrial Training :17 Seminars: 5 credits, Indian Knowledge System: 2 credits, Sustainable Development Goals: 2 credits.

To ensure a comprehensive learning experience, detailed evaluation schemes and rubrics have also been meticulously provided.

For each course, a thorough mapping of Course Outcomes, Program Outcomes, and Program Specific Outcomes has been undertaken. As the course syllabus is being meticulously developed, various elements such as session outcomes, laboratory instruction, classroom instruction, self-learning activities, assignments and mini projects are meticulously outlined.

We hold the belief that this dynamic curriculum will undoubtedly enhance independent thinking, skills and overall employability of the students.

Department of Agriculture Engineering and Food Technology
AKS University, Satna
01 August 2023

Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
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Introduction :

AKS University proudly stands as a pioneer, being the first in the nation to introduce a comprehensive 4-year B. Tech program in Food Technology back in 2014. This innovative curriculum has been meticulously crafted to align with the dynamic needs of the Food industry and the most current technological advancements. Currently, a vibrant community of 133 students is actively engaged in pursuing their B. Tech in Food Technology within this department. The Department of Agriculture Engineering and Food Technology boasts cutting-edge laboratories that serve as hubs for immersive hands-on training, enabling students to delve into practical applications of their learning. The program incorporates both in-plant training and sandwich apprenticeship training, vital components that enrich the educational journey. Distinguished by a faculty composed of Food industry experts who bring with them a wealth of industrial experience, the department combines robust classroom instruction with practical and industrial acumen. This unique blend empowers our students to confidently contribute to Food plants and makea significant impact in the field.

Vision :

To conduct its key programs and activities in a unique manner that promotes excellence and leadership in education, research, innovation in food technology and fosters an environment that is safe, highly productive, cooperative and collegial, and dedicated to continual improvement.

Mission :

M 01 : Achieve academic excellence in Food Technology through an innovative teaching-learningprocess.

M 02 : Application of sustainable food processing technology in food manufacture without compromising quality.

M 03 : Inculcate technical competence and collective discipline in students to excel for food manufacturing units , higher education and societal needs.

M 04 : Establish focus research groups in leading areas of food technology for optimization ofproduction and quality parameters in food manufacture and environmental needs.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 01: To develop technical and managerial skills among the students with practical knowledge to Work in Food manufacturing unit and able to handle day to day plant problems.

PEO 02 : To develop R&D temperament among the students for development, innovation and

sustainable technology in food manufacturing process.

POE 03 : To develop ethical principles among the students and commitment to fulfilling international, national and local needs and social responsibilities with his/her professional excellence.

PEO 04 : Ability to understand the impact of professional engineering solutions in societal, economic and environmental contexts and demonstrate knowledge and need for sustainable development

Program Outcomes (POs)

B .Tech (Food Technology) Graduate will able to perform:

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO 3: Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO 5: **Modern tool usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to theprofessional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge and need for sustainable development.

PO 8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

On completion of B. Tech. Food Technology program, the students will achieve the following programspecific outcomes:-

PSO 1 : The ability to apply technical & engineering knowledge for production & quality of food products with the available raw material resources.

PSO 2: Ability to understand the day to plant operational problems of food manufacture and provide economical solution to enhance the production without compromising quality of food products.

PSO 3: Ability to understand the latest food manufacturing technology and it applications in optimization ofproduction and quality parameters in food manufacture.

PSO 4: Ability to use the research based innovative knowledge for sustainable development in food manufacture.

Consistency/Mapping of PEOs with Mission of the Department

PEO	M 1	M 2	M 3	M 4
PEO 1	3	2	3	2
PEO 2	2	2	2	3
PEO 3	2	3	2	1
PEO 4	2	2	3	3

1*: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-": No correlation*

GENERAL COURSE STRUCTURE & THEME

1. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

2. Range of Credits:

In the light of the fact that a typical Model Four-year Under Graduate degree program in Food Technology has about 191 credits, the total number of credits proposed for the four-year B. Tech.in Food Technology.

3. Structure of UG Program in Food Technology:

The structure of UG program in Food Technology shall have essentially the following categories of courses with the breakup of credits as given:

Components of the Curriculum
(Program curriculum grouping based on course components)

Sl No	Course Component	% of total number of credits of the Program	Total number of Credits
1	Basic Sciences (BSC)	**9.09**	**17**
2	Engineering Sciences (ESC)	**9.62**	**18**
3	Humanities and Social Sciences (HMSC)	**5.34**	**10**
4	Program Core (PCC)	**52.40**	**98**
5	Program Electives (PEC)	**1.6**	**3**
6	Open Electives (OEC)	**00**	**00**
7	Research Project	**8.02**	**15**
9	Industrial Training	**9.09**	**17**
10	Seminar(PSC)	**2.67**	**5**
11	Indian Knowledge System	**1.06**	**2**
12	Sustainable Development Goal	**1.06**	**2**
	Total	**100.00**	**191**

General Course Structure and Credit Distribution
B.Tech. (Food Tech.) Semester-I

Sr.	Subject Code	Name of course	L (Hr)	P (Hr)	Credit
1.	54SD121	English Language	1	2	2
2.	54MB122	General Microbiology	2	2	3
3.	54PH123	Engineering Physics	2	2	3
4.	54ME124	Engineering Drawing and Graphics	1	4	3
5.	54ME125	Workshop Technology	1	4	3
6.	Elective- Choose Any one of these		2		2
	54BI126-A	Elementary Biology *(For Maths Students)*			
	54MS126-B	Elementary Mathematics *(For Bio/Ag Students)*			
7.	54EE127	Electrical Engineering	2	2	3
8.	54FT130	Introduction to Food Science and Technology	2	2	3
9	54EV129	Environmental Sciences & Disaster Management	1	2	2
10	SDG101	Sustainable Development Goal	2		2
		Total credits			26

B Tech (Food Technology),II Semester

(as per V Dean of ICAR)

Scheme & Syllabus

Sr.No.	Course Code	Course	Group	L (Hr)	T (Hr)	P (Hr)	Credit
1	54FT221	Food Chemistry of Macronutrients	Food Tech	2	0	2	**3**
2	54FT222	Food Microbiology	Biotech	2	0	2	**3**
3	54FT223	Food Thermodynamics	Mechanical	2	0	2	**3**
4	54CA224	Computer Programming and Data Structures	Computer Sc.	1	0	4	**3**
5	54ME225	Fluid Mechanics	Mechanical	2	0	2	**3**
6	54EE226	Basic Electronics Engineering	Electrical	2	0	2	**3**
7	54MS227	Engineering Mathematics-I	Maths	2	0		**2**
8	54AE228	Post Harvest Engineering	Agril. Engg.	2	0	2	**3**
9	0IKS04	Indian Knowledge System	SDG	2			2
	Total Credit						**25**

B.Tech. (Food Tech.)

Semester-III

Sr. No.	Course Code	Course	L (Hr)	P (Hr.)	Credit
1	54MS321	Engineering Mathematics-II	2		2
2	54FT322	Fundamentals of Food Processing	2	2	3
3	54FT323	Processing Technology of Milk and Milk Products	2	2	3
4	54FT324	Processing Technology of Cereals	2	2	3
5	54BT325	Industrial Microbiology	2	2	3
6	54FT326	Food Chemistry of Micronutrients	2	2	3
7	54ME327	Heat and Mass Transfer in Food Processing	2	2	3
8	54FT328	Unit Operation in Food Processing-I	2	2	3
9	54FT378	Skill Development (Bakery)- Lab		2	1
		Total	**16**	**16**	**24**

B Tech (Food Technology)

IV Semester

(as per V Dean of ICAR)

Scheme & Syllabus

Sr.No.	Course Code	Course	Group	L (Hr)	T (Hr)	P (Hr)	Credit
1	54FT421	Processing Technology of Pulses and Oilseeds	Food Tech	3	0	2	**3+1=4**
2	54FT422	Food Biochemistry and Nutrition	Food Tech	3	0	2	**3+1=4**
3	54FT423	Unit Operation in Food Processing-II	Food Tech	3	0	2	**3+1=4**
4	54FT424	Food Biotechnology	Biotech	2	0	2	**2+1=3**
5	54FT425	Food Refrigeration and Cold Chain	Mechanical	2	0	2	**2+1=3**
6	54FT426	Processing of Spices and Plantation Crops	Food Tech	2	0	2	**2+1=3**
7	54FT477	Skill Development (Cereals and Pulses Processing)-Lab	Food Tech			4	**0+2=2**
	Total Credit						**23**

B Tech (Food Technology)

V Semester

Sr.No.	Course Code	Course	L	T	P	Credit
Theory						
1	54FT521	Processing Technology of Fruits and Vegetables	2	0	2	**3**
2	54FT522	Processing Technology of Meat and Poultry Products	2	0	2	**3**
3	54FT523	Instrumental Techniques in Food Analysis	2	0	2	**3**
4	54FT524	ICT Applications in Food Industry	2	0	2	**3**
5	54FT525	Food Process Equipments and Design	2	0	0	**2**
6	54FT526	Bakery, Confectionery and Snack Products	2	0	2	**3**
7	54FT527	Marketing Management and International Trade	2	0	0	**2**
Practicals						
1	54FT576	Skill Development (Confectionary)-Lab			4	**2**
2	54FT577	Industrial Training-I				**5**
Total Credit						**26**

B.Tech. (Food Tech.)
Semester-VI
Distribution of courses as per 5th Dean Committee

Sr. No.	Course Code	Course	Group	L (Hr)	P (Hr.)	Credit
1	54FT621	Processing Technology of Beverages	Food Tech	2	2	2+1=3
2	54FT622	Food Plant Sanitation	Food Tech	1	2	1+1=2
3	54FT623	Food Packaging Technology and Equipment	Food Tech	2	2	2+1=3
4	54FT624	Processing of Fish and Marine Products	Food Tech	2	2	2+1=3
5	54FT625	Sensory Evaluation of Food Products	Food Tech	2	2	2+1=3
6	54FT626	Food Additives and Preservatives	Food Tech	1	2	1+1=2
7	54FT627	Food Quality ,Safety, Standards and Certification	Food Tech	3	2	3+1=4
8	54FT628	Instrumentation and Process Control in Food Industry		2	2	2+1=3
9	54FT679	Skill Development (Milk and Milk Products)-Lab	Food Tech		4	0+2=2
		Total		**15**	**20**	**25**

B Tech (Food Technology)

VII Semester

Sr.No.	Course Code	Course	L	T	P	Credit
Theory Subject						
1	54FT721	Entrepreneurship Development	3	0	0	**3**
2	**54FT722**	**Elective**	3	0	0	**3**
Practicals						
1	54FT771	Skill Development (Fruits and Vegetable Processing)- Lab			8	**4**
2	54FT772	Industrial Training-II				**5**
3	54FT773	Seminar				**5**
Total Credit						**20**

Elective (Choose any one of these)

54FT722-A	Novel Separation Technology
54FT722-B	Food Flavour Technology
54FT722-C	Food Toxicology
54FT722-D	Food Law and Regulation
54FT722-E	Nutracuticals and Health Food
54FT722-F	Food Quality Testing and Evaluation

B Tech (Food Technology)

Scheme and Syllabus

Semester-VIII

Sr.No.	Course Code	Course	Group	L	T	P	Credit
	Practicals						
1	54FT871	Research Project	Food Tech				15
2	54FT872	Industrial Training-III	Food Tech				07
		Total Credit					**22**

Total number of Course-61

Grand Total of Credit Hours - 191

Course code and definition:

L	=	Lecture
T	=	Tutorial
P	=	Practical
C	=	Credit
BSC	=	Basic Science Courses
ESC	=	Engineering Science Courses
HSMC	=	Humanities and Social Sciences including Management courses
PCC	=	Professional core courses
PEC	=	Professional Elective courses
OEC	=	Open Elective courses
LC	=	Laboratory course
MC	=	Mandatory courses
IKS	=	Indian Knowledge System
SDGs	=	Sustainable Development Goals

Course level coding scheme:

Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the year in which course is offered.

Category-wise Courses:

Humanities, Social Sciences and Management Courses (HSM)

Sl.	Code No.	Course	Semester	Credits
1	54SD121	English Language	1	2
3	54FT721	Entrepreneurship Development	7	3
4	SDGs 01	Sustainable Development Goals	2	2
5	IKS 01	Indian Knowledge System	1	2
			Total Credits:	**09**

Basic and Applied Sciences Course(BASC)

Sl.	Code No.	Course	Semester	Credits
1	54MB122	General Microbiology	1	3
2	54BI126-A	Elementary Biology ***(For Maths Students)***	1	2
3	54MS126-B	Elementary Mathematics ***(For Bio/Ag Students)***	1	
4	54EV129	Environmental Sciences & Disaster Management	1	2
5	54MS227	Engineering Mathematics-I	2	2
6	54MS321	Engineering Mathematics-II	3	2
7	54BT325	Industrial Microbiology	3	3
			Total Credits:	**14**

Engineering Sciences Course (ESC)

Sl.	Code No.	Course	Semester	Credits
1	54ME124	Engineering Drawing and Graphics	1	3
2	54ME125	Workshop Technology	1	3
3	54PH123	Engineering Physics	1	3
4	54EE127	Electrical Engineering	1	3
5	54CA224	Computer Programming and Data Structures	2	3
6	54ME225	Fluid Mechanics	2	3
7	54EE226	Basic Electronics Engineering	2	3
8	54ME327	Heat and Mass Transfer in Food Processing	3	3
9	54AE228	Post Harvest Engineering	2	3
			Total Credits:	**27**

Professional Core Courses (PCC)

Sl.	Code No.	Course	Semester	Credits
1	54FT130	Introduction to Food Science and Technology	1	2
2	54FT221	Food Chemistry of Macronutrients	2	3
3	54FT222	Food Microbiology	2	3
4	54FT223	Food Thermodynamics	2	3
5	54FT322	Fundamentals of Food Processing	3	3
6	54FT323	Processing Technology of Milk and Milk Products	3	3
7	54FT324	Processing Technology of Cereals	3	3
8	54FT326	Food Chemistry of Micronutrients	3	3
9	54FT328	Unit Operation in Food Processing-I	3	3
10	54FT378	Skill Development (Bakery)- Lab	3	1
11	54FT421	Processing Technology of Pulses and Oilseeds	4	4
12	54FT422	Food Biochemistry and Nutrition	4	4
13	54FT423	Unit Operation in Food Processing-II	4	4
14	54FT424	Food Biotechnology	4	3
15	54FT425	Food Refrigeration and Cold Chain	4	3
16	54FT426	Processing of Spices and Plantation Crops	4	3
17	54FT477	Skill Development (Cereals and Pulses Processing)-Lab	4	2
18	54FT521	Processing Technology of Fruits and Vegetables	5	3
19	54FT522	Processing Technology of Meat and Poultry Products	5	3
20	54FT523	Instrumental Techniques in Food Analysis	5	3
21	54FT524	ICT Applications in Food Industry	5	3
22	54FT525	Food Process Equipments and Design	5	2
23	54FT526	Bakery, Confectionery and Snack Products	5	3
24	54FT527	Marketing Management and International Trade	5	2
25	54FT576	Skill Development (Confectionary)-Lab	5	2
26	54FT621	Processing Technology of Beverages	6	3
27	54FT622	Food Plant Sanitation	6	2
28	54FT623	Food Packaging Technology and Equipment	6	3
29	54FT624	Processing of Fish and Marine Products	6	3
30	54FT625	Sensory Evaluation of Food Products	6	3
31	54FT626	Food Additives and Preservatives	6	2
32	54FT627	Food Quality ,Safety, Standards and Certification	6	4

33	54FT628	Instrumentation and Process Control in Food Industry	6	3
34	54FT679	Skill Development (Milk and Milk Products)- Lab	6	2
35	54FT771	Skill Development (Fruits and Vegetable Processing)-Lab	7	4
36	54FT527	Marketing Management and International Trade	5	2
Total Credit				**102**

Professional Elective Courses (PEC)

Sl.	Code No.	Course	Semester	Credits
1	**54FT722**	**Elective** A-Novel Separation Technology B-Food Flavour Technology C-Food Toxicology D-Food Law and Regulation E-Nutracuticals and Health Food F-Food Quality Testing and Evaluation	**7**	**3**
Total Credit				**3**
Industrial Training Group				
1	54FT577	Industrial Training-I		5
2	54FT772	Industrial Training-II		5
3	54FT872	Industrial Training-III		7
Total Credit				**17**

Faculty of Agriculture Science & Technology
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Research Project

Sl.	Code No.	Course	Semester	Credits
1	54FT773	Seminar		5
2	54FT871	Research Project		15
Total Credit				**20**

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Induction Program

Induction program for students to be offered right at the start of the first year. It is mandatory. AKS University has design an induction program for 1st year student, details are below:

1. Physical activity
2. Creative Arts
3. Universal Human Values
4. Literary
5. Proficiency Modules
6. Lectures by Eminent People
7. Visits to local Areas
8. Familiarization to Dept./Branch & Innovations

Mandatory Visits/ Workshop/Expert Lectures:

1. It is mandatory to arrange one industrial visit every semester for the students.

2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester onprofessional/ industry/ entrepreneurial orientation.

3. It is mandatory to organize at least one expert lecture per semester for each branch by invitingresource persons from industry.

Evaluation Scheme:

1. **For Theory Courses:**
   a. The weightage of Internal assessment is 50% and
   b. End Semester Exam is 50% The student has to obtain at least 50% marks individually both in internal assessment and endsemester exams to pass.
2. **For Practical Courses:**
   a. The weightage of Internal assessment is 50% and
   b. End Semester Exam is 50% The student has to obtain at least 50% marks individually both in internal assessment and endsemester exams to pass.
3. **For Summer Internship / Projects / Seminar etc.**
   Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc

Semester wise Course Structure

Semester wise Brief of total Credits and Teaching Hours

Semester	L	T	P	Total Hour	Total Credit
Semester -I	16	0	10	36	26
Semester -II	17	0	8	33	25
Semester -III	16	0	8	32	24
Semester - IV	15	0	8	31	23
Semester -V	14	0	12	38	26
Semester -VI	15	0	10	35	25
Semester - VII	6	0	14	34	20
Semester -VIII	0	0	22	44	22
Total	**99**		**92**	**283**	**191**

Total credit : 191

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Semester- I

Course Code:	54ME124
Course Title :	Engineering Drawing & Graphics
Pre- requisite:	Student should have basic knowledge of Geometry, Geometrical Shapes, basic knowledge of Computer, Mouse and keyboard use, navigating menus and dialogs, managing files and directories, etc.
Rationale:	Engineering drawings are used across various engineering fields. - Drawings contain graphics and text and can show front, top, and side views of an object. Instruments are used to precisely draw lines, circles and curves to scale. Drawings are often made using CAD software.

Course Outcomes (CO):

Course Code	Course Outcomes
54ME124.1	Understand the Knowledge of Orthographic Projection
54ME124.2	Acquire the Knowledge of dimensioning and riveted joint
54ME124.3	Understand the Preparation of welded joint
54ME124.4	Apply the knowledge of Square headed and hexagonal nuts and bolts
54ME124.5	Acquire the Knowledge of Application of computers for design

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Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54ME124	Engineering Drawing & Graphics	1	4	1	1	7	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54ME 124	Engineering Drawing & Graphics	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME124.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 Apply First and Third Angle projection methods confidently in engineering drawings**.** SO1.2 Translate 3D models and isometric views into precise working drawings. SO1.3 Draw missing views effectively to enhance spatial communication in engineering drawings. SO1.4 Apply projection methods in practical engineering scenarios for Hands-on experience. SO 1.5 Seamlessly integrates isometric views into working drawings for enhanced communication in design documentation.	**1-** Projection of plane **2-** Projection of solid	1- First and third angle methods of projection; 2- Preparation of working drawing from models and isometric views; 3- Drawing of missing views	1- Projection of pentagonal prism

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME124.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Apply diverse dimensioning methods for accurate engineering drawings. SO2.2 Master sectioning to communicate internal features effectively. SO2.3 Proficiently create revolved and oblique sections for complex objects. SO2.4 Produce detailed sectional drawings of machine parts to industry standards. SO2.5 Understand and apply various rivet heads and joints For clear engineering communication.	1- Section of solids and interpenetration of solid- surfaces 2- Drawing of riveted joints and thread fasteners;	1-Different methods of dimensioning; Concept of sectioning 2- Revolved and oblique section; Sectional drawing of simple machine parts; 3- Types of rivet heads and riveted joints; Processes for producing leak proof joints.	1- Development of pentagonal prism

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME124.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Proficiently use symbols for diverse welded joint types in engineering drawings. SO3.2 Master thread nomenclature, including profiles, multi-start threads, and left/right- hand distinctions. SO3.3 Accurately apply welded joint symbols for clear communication in engineering drawings. SO3.4 Analyze various thread profiles and types, applying knowledge in practical mechanical design scenarios. SO3.5 Integrate welding joint symbols and thread nomenclature into engineering drawings for effective communication in manufacturing and assembly processes.	1-Isometric projection of geometrical solids 2- Preparation of manual drawings with dimensions from models and isometric drawings of objects and machine components; Preparation of sectional drawings of simple machine parts;	1- Symbols for different types of welded joints; 2- Nomenclature, thread profiles, multi-start thread 3- left and right hand thread;	1- multi-start thread

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME124.4

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Participants will differentiate between square-headed and hexagonal nuts and bolts, understanding their applications. SO4.2 Attendees will demonstrate proficiency in drawing and interpreting conventional representations of threads in engineering drawings. SO4.3 Participants will identify and compare various types of lock nuts, distinguishing their functionalities and advantages. SO4.4 Students will recognize and explain the distinct uses of studs, machine screws, cap screws, and wood screws in engineering applications. SO4.5 Participants will apply foundational knowledge to design processes, selecting appropriate fasteners and considering safety and communication aspects.	1- Preparation of sectional drawings of simple machine parts; 2- Demonstration on computer graphics and computer aided drafting use of standard software	1-Square headed and hexagonal nuts and bolts; 2- Different types of lock nuts, studs, machine screws, 3- cap screws and wood screws; Foundation bolts; Design process,	1- Conventional representation of threads

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME124.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Participants will comprehend the fundamental principles and applications of Computer-Aided Design (CAD). SO5.2 Students will articulate the advantages of CAD, recognizing its impact on efficiency and innovation in design SO5.3 Attendees will identify and analyze the key components of a CAD system, understanding their Collaborative role in the design process. SO5.4 Participants will grasp the specific hardware requirements for CAD, recognizing the importance of optimized configurations. SO5.5 Students will integrate their knowledge by evaluating real-world examples, showcasing a comprehensive understanding of CAD applications in diverse industries.	1. Practice in the use of basic and drawing commands on AutoCAD 2. Generating simple 2-D drawings with dimensioning using AutoCAD	1-Application of computers for design, definition of CAD 2- benefits of CAD, CAD system components; 3- Computer hardware for CAD.	1. Small Projects using CAD/CAM.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54ME124.1: Understand the Knowledge of Orthographic Projection	3	4	1	1	09
54ME124.2: Acquire the Knowledge of dimensioning and riveted joint	3	4	1	1	09
54ME124.3: Understand the Preparation of welded joint	3	4	1	1	09
54ME124.4: Apply the knowledge of Square headed and hexagonal nuts and bolts	3	4	1	1	09
54ME124.5: Acquire the Knowledge of Application of computers for design	3	4	1	1	09
Total Hours	15	20	5	5	45

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Orthographic Projection	03	03	01	07
CO-2	Dimensioning and riveted joint	03	05	02	10
CO-3	Welded joint	02	06	03	11
CO-4	Square headed and hexagonal nuts and bolts	03	04	04	11
CO-5	Application of computers for design	02	04	05	11
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Engineering Drawing & Graphics will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S.No.	Title	Author	Publisher	Edition & Year
1	Mastering CAD/CAM.	Ibrahim Zeid.	McGraw-Hill BookCo., NY, USA.	2004
2	Principles of CAD/CAM/CAE Systems	Kunwoo Lee.	Prentice-Hall, USA.	1999
3	Machine Drawing.	N.D. Bhat and V.M.Panchal.	Charotar Publishing House, Anand.	1995
4	Elementary Engineering Drawing.	N.D. Bhat.	Charotar Publishing House, Anand.	1995

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54ME124
Course Title: Engineering Drawing & Graphics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Orthographic Projection	1	2	3	3	2	2	1	1	3	2	1	1	2	2	3	3
CO2 dimensioning and riveted joint	3	3	2	1	1	2	2	3	1	2	3	2	3	1	2	3
CO3 3 welded joint	1	1	2	2	3	3	1	2	2	1	1	2	1	1	2	2
CO4 Square headed and hexagonal nuts and bolts	2	2	2	1	1	1	3	2	1	2	1	3	1	2	2	1
CO5 Application of computers for design	2	2	1	1	1	2	2	3	1	2	1	1	2	1	3	1

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Orthographic Projection	**SOs 1-5**	4	First and third angle methods of projection; Preparation of working drawing from models and isometric views; Drawing of missing views;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Dimensioning and riveted joint	**SOs 1-5**	4	Different methods of dimensioning; Concept of sectioning; Revolved and oblique section; Sectional drawing of simple machine parts; Types of rivet heads and riveted joints; Processes for producing leak proof joints.	
PO 1 to 12 and PSO 1 to 4	CO3: Welded joint	**SOs 1-5**	4	Symbols for different types of welded joints; Nomenclature, thread profiles, multi-start threads, left and right hand thread;	
PO 1 to 12 and PSO 1 to 4	CO4: Square headed and hexagonal nuts and bolts	**SOs 1-5**	4	Square headed and hexagonal nuts and bolts; Conventional representation of threads; Different types of lock nuts, studs, machine screws, cap screws and wood screws; Foundation bolts; Design process,	
PO 1 to 12 and PSO 1 to 4	CO5: Application of computers for design	**SOs 1-5**	4	Application of computers for design, definition of CAD, benefits of CAD, CAD system components; Computer hardware for CAD.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54EE127
Course Title :	Electrical Engineering
Pre- requisite:	Students should have basic knowledge of Electrostatics, and Electromagnetic Concepts.
Rationale:	A process of introducing formal knowledge of electrical machine principles, construction, and working of various transformers, D.C. machines, Induction machines, and Single-Phase machines with measurement of AC circuits & connections.

Course Outcomes (CO):

Course Code	Course Outcomes
54EE127.1	Understand the knowledge of Basic AC fundamental Principles and Various Circuit Connections.
54EE127.2	Understand the knowledge of Construction and Working of the Transformer.
54EE127.3	Understand the Construction and Working of Single-Phase Induction Machines, Poly-Phase Induction Machines, and DC Machines.
54EE127.4	Evaluate the Concepts of DC Motors, and Power Economics.
54EE127.5	Gain knowledge of the Measuring Instruments and Protection Scheme, and Electric Wiring.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54EE127	Electrical Engineering	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54EE 127	Electrical Engineering	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE127.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the concepts of AC fundamentals. SO1.2 Understand the Laws of Magnetic Circuit SO1.3 Understand the various circuit connections. SO1.4 Understand the Power Measurement techniques on single-phase, and three-phase. .	1-Study of voltage resonance in L.C.R. circuits at constant frequency: (a) Star connection study of voltage and current relation. (b) Delta connection study of voltage and current relation. 2- Measurement of Power in 3 phase circuit by wattmeter and energy meter: (a) for balanced loads, (b) for unbalanced loads.	1-AC Fundamentals: 2-Definitions of cycle, frequency, period, amplitude, 3-Peak value, RMS value, Average value, Electromotive force, reluctance, etc. 4-laws of magnetic circuits Phase relations and vector representation, 5-AC through resistance, inductance, and capacitance. 6-A.C. series and parallel circuits. Simple R-L, R-C, and R-L-C circuits. 3 Phase Systems: Star and Delta connections. Relationship between line and phase voltages and currents in Star and Delta connections. various methods of single and three-phase power measurement.	Knowledge About the concept of AC Fundamentals.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE127.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 To Understand the construction, and working of a single-phase transformer. Derive the EMF equation. SO2.2 Draw Phasor Diagram.To understand the Ideal Transformer. To learn the working of transformers at different loads. SO2.3 Draw the equivalent Circuit diagram. SO2.4 To acknowledge the losses in the transformer. SO2.5 To learn the efficiency and regulation concept. To determine the O.C. and S.C. Tests.	1-Polarity test, no-load test, efficiency and regulation test of single-phase transformer, Starting of induction motors by; (a) D.O.L. (b) Manual star delta (c) Automatic star delta starts. 2-Starting of slip ring Induction motors by normal and automatic rotor resistance starters.	1-Transformer Construction Working 2-EMF equation 3-Phasor Diagram Ideal Transformer Equivalent Circuit 4- Transformer 5-Losses Efficiency Regulation 6-Open Circuit Test Short Circuit Test	1-Knowing about the basic concept of Transformer.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE127.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 To Understand the construction, and working of a single-phase Induction Machine. SO3.2 To Understand the different types of single-phase Induction Machine. SO3.3 To Understand Construction and Working of Poly-Phase Induction Machine. SO3.4 To understand the concept of the DC Machines. SO3.5 To learn about the Performance Characteristics of DC Machines.	1-Test on 3 phase induction motor determination of efficiency, line current, speed slip and power factor at various outputs. 2-Determination of relation between the induced armature voltage and speed of separately excited D.C. generator.	1-Single-Phase, and Three-Phase Induction Machine, 2-DC Machines. Single-Phase I.M. Double Field Revolving Theory Equivalent Circuit 3- Performance Characteristic Phase-Split Motor 4-Shaded-Pole Motor Poly-Phase I.M. Equivalent Circuit 5-Phasor Diagram Effect of rotor resistance Torque Equation Starting, and Speed Control Methods 6-DC Machine Armature Reaction Commutation Process Performance Characteristics	1-Knowing about different types of I.M.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE127.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding the operation of DC Motors. SO4.2 Understanding the Starting Techniques of DC Machine. SO4.3 Understanding the Speed Control Methods. SO4.4 Understanding the Performance Characteristics. SO4.5 Understanding the concept of electrical power economics.	1-Magnetization characteristics of D.C. generator. 2-Study the starter connection and starting reversing and adjusting speed of a D.C. motor.	1-Operation Starting Speed Control Methods 2-Performance Characteristics Electrical Power 3-Economics Load Factor 4-Maximum Demand Factor 5-Power Factor, 6-Power Factor Improvement	1-Knowing about the DC Motors.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE127.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1 Knowledge about different measuring instruments. SO5.2 Knowledge about the electrical wiring. SO5.3 Knowledge about the Protection Devices. SO5.4 Knowledge about the Earthing System. SO5.5 Application of Relays, and Circuit Breakers.	1-Problems on Industrial Electrification Study of various circuit protection devices. 2-Study of various measuring instruments.	1-Measuring Equipment: Classification Characteristics of Different Electrical Measuring Systems 2-Measuring Equipment: Classification Characteristics of different Equipment, 3-Electrical Wiring, a system of wiring 4-Domestic Wiring Installation Industrial electrification 5-Protection Devices Earthing 6-Use of Multimeter Circuit protection devices Fuses MCB ELCB & Relays	1-Application Of measuring instruments.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54EE127.1: Understand the knowledge of AC Fundamentals.	6	4	1	1	12
54EE127.2: Understand the knowledge of the Transformer.	6	4	1	1	12
54EE127.3: Analyze Single-Phase, and Three-Phase Induction Machine, DC Machines.	6	4	1	1	12
54EE127.4: Evaluate the Concept of DC Motor, and Power Economics.	6	4	1	1	12
54EE127.5: Apply the knowledge of the Measuring Instruments and Protection Scheme.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	A.C. Fundamentals	03	02	01	06
CO-2	Transformer.	02	05	03	10
CO-3	Single-Phase, and Three-Phase Induction Machine, DC Machines.	02	05	05	12
CO-4	DC Motor, and Power Economics.	03	04	03	10
CO-5	Measuring Instruments, and Protection Scheme.	03	04	05	12
Total		13	20	17	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Electrical Engineering will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S.No.	Title	Author	Publisher	Edition & Year
1	A Textbook of Electrical Technology	B.L. Theraja, and A.K. Theraja	S. Chand & Company Ltd., New Delhi	2005 Vol. 2
2	Electrical Engineering Fundamentals	Vincent Del Toro	Prentice-Hall India Private Ltd., New Delhi	2000
3	Other lecture notes provided by the Department of Electrical Engineering, AKS University, Satna (M.P).			

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54EE127
Course Title: Electrical Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 A.C. Fundamentals	3	1	1	1	2	3	3	2	3	3	2	3	3	3	3	3
CO2 Transformer.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO3 Single-Phase, and Three-Phase Induction Machine, DC Machines.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO4 DC Motor, and Power Economics.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO5 Measuring Instruments, and Protection Scheme.	3	2	1	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: A.C. Fundamentals	**SOs 1-5**	4	AC Fundamentals: Definitions of cycle, frequency, time period, amplitude, Peak value, RMS value, Average value, Electro motive force, reluctance etc, laws of magnetic circuits, Phase relations and vector representation, AC through resistance, inductance and capacitance, A.C. series and parallel circuits, Simple R-L, R-C and R-L-C circuits, 3 Phase Systems: Star and Delta connections, Relationship between line and phase voltages and currents in Star and Delta connections, various methods of single and three phase power measurement.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Transformer.	**SOs 1-5**	4	Transformer : Principle of working, construction of single phase transformer, emf equation, Phasor diagrams, Ideal transformer, transformer on no load, Transformer under load, Equivalent circuits, Transformer losses, efficiency, Regulation, Open and short circuit test.	
PO 1 to 12 and PSO 1 to 4	CO3: Single-Phase, and Three-Phase Induction Machine, DC Machines.	**SOs 1-5**	4	Single phase induction motor: double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors. Poly-phase induction motor: Construction, operation, equivalent circuit, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods, D.C. Machine (generator and motor): Types, Construction and Operation, EMF equation, armature reaction, commutation of D.C. generator and their characteristics,	
PO 1 to 12 and PSO 1 to 4	CO4: DC Motor, and Power Economics.	**SOs 1-5**	4	D.C. Motors, their starting, speed controls and characteristics. Electric Power Economics, Maximum demand charge, Load factor, power factor and power factor improvement,	
PO 1 to 12 and PSO 1 to 4	CO5: Measuring Instruments, and Protection	**SOs 1-5**	4	Measuring Equipment's: Classification, Characteristics of different electrical measuring systems and equipment's, Electrical Wiring, system of wiring, domestic wiring installation, industrial electrification, protection devices, Earthing, use of Multimeter, Circuit protection devices, fuses, MCB, ELCB & relays.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54BI126-A
Course Title :	Elementary Biology
Pre- requisite:	Students should have basic knowledge of various metabolisms of Human body and nutritional demand.
Rationale:	Elementary Biology is designed for students who are interested in acquiring a comprehensive understanding of the various branches of the life sciences. The major combines a thorough foundation in biological and physical sciences with a range of elective courses and transcript-visible options that can be customized to align with specific career objectives. Biology majors undergo rigorous preparation for advanced academic and vocational programmers, with the option to specialize in areas such as ecology, genetics, marine biology, physiology and behavior, pre-dentistry/biology, pre-education/biology, pre-medicine/biology, and pre-veterinary medicine. The biology major offers options that necessitate a maximum of fifteen additional credits (equivalent to one term) beyond the fundamental major requirements.

Course Outcomes (CO):

Course Code	Course Outcomes
54BI126-A.1	Describe the diversity of Life and theories of its Origin.
54BI126-A.2	Explain the basics of Botany and Zoology.
54BI126-A.3	Acquired the knowledge for Morphology of Frog.
54BI126-A.4	Explain the internal organ system of Frog.
54BI126-A.5	Demonstrate approach towards Lower Botany.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54BI126-A	Elementary Biology	2	0	1	1	4	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		Home Assessment (HA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +HA+ESE)
			SA 1	SA2			
PCFT	54BI 126-A	Elementary Biology	20	20	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BI126-A.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand structure of Life SO1.2 Understand Origin of Life SO1.3 Understanding the Oparin's abiotic theory SO1.4 Understanding the Evolution SO1.5 Understanding the Cell Biology.		1 Life; Living and non living 2. Origin of Life 3. Oparin's abiotic theory 4. Evolution; Unicellular 5.Multicellularity Complex Tissue system 6. Branches of Biology; Cell	Knowledge about various Organ Systems

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BI126-A.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand Introduction to Botany SO2.2 Understand History of Botany SO2.3 Understanding branches of Botany SO2.4 Understanding Terminology of Botany SO2.5 Understanding Zoology.		1. Introduction to Botany 2. History of Botany 3. Brief introduction of branches of Botany 4. Morphology; Anatomy; Taxonomy; Physiology; 5.Palaeo Botany 6. Introduction to Zoology	Knowledge about Ecology around native places

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BI126-A.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand fungi, algae and protozoa and virus SO3.2 Understand Nutrient transport phenomenon SO3.3 Understanding Microbial genetics		1.1 Classification of Animal kingdom 1.2 Classification of Animal kingdom 2.1 Adaptation of animals 2.2 Adaptation of animals 3.1 External Morphology of Frog 3.2 External Morphology of Frog	Knowledge about types of Frog

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BI126-A.4

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understand Internal Organs SO4.2 Understand Organ System		1.1. Internal Anatomy of Frog 1.2. Internal Anatomy of Frog 2.1 Internal organs 2.2 Internal organs 3.1 Different internal systems 3.2 Different internal systems	Comparative Functions of Organ system of Frog with Humans

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BI126-A.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Lower Botany SO5.2 Understand Bryophyte and Pteridophyte SO5.3 Understanding Scope/Application of Biology		1.Introduction to Lower Botany; Algae, Fungi, 2.Bacteria, Virus 3.Bryophyte; 4.Pteridophyte 5.Scope of Biology 6.Application of Biology	Knowledge about Microbes and Cell system

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54BI126-A.1: Describe the diversity of Life and theories of its Origin.	6	0	1	1	8
54BI126-A.2: Explain the basics of Botany and Zoology.	6	0	1	1	8
54BI126-A.3: Acquired the knowledge for Morphology of Frog.	6	0	1	1	8
54BI126-A.4: Explain the internal organ system of Frog.	6	0	1	1	8
54BI126-A.5: Demonstrate approach towards Lower Botany.	6	0	1	1	8
Total Hours	30	00	5	5	40

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Diversity of Life and theories of its Origin.	03	02	01	06
CO-2	Basics of Botany and Zoology.	03	05	03	11
CO-3	Morphology of Frog.	03	05	03	11
CO-4	Internal organ system of Frog.	03	05	03	11
CO-5	Lower Botany.	03	03	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Elementary Biology will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Trueman's Elementary Biology	N K Bhatiya	Trueman Publication	2022, 2th Ed

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54BI126-A
Course Title: Elementary Biology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Diversity of Life and theories of its Origin	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2 Basics of Botany and Zoology.	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO3 Morphology of Frog.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4 Internal organ system of Frog.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5 Lower Botany.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Diversity of Life and theories of its Origin.	**SOs 1-5**	4	Life; Living and non living; Origin of Life; Oparin's abiotic theory; Evolution; Unicellular Multicellularity Complex Tissue system, Branches of Biology; Cell.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Basics of Botany and Zoology.	**SOs 1-5**	4	Introduction Botany; History of Botany; Brief introduction of branches of Botany; Morphology; Anatomy; Taxonomy; Physiology; Palaeo Botany; Introduction Zoology.	
PO 1 to 12 and PSO 1 to 4	CO3: Morphology of Frog.	**SOs 1-5**	4	Classification of Animal kingdom; Adaptation of animals; External Morphology of Frog.	
PO 1 to 12 and PSO 1 to 4	CO4: Internal organ system of Frog.	**SOs 1-5**	4	Internal Anatomy of Frog, Internal organs; Different internal systems	
PO 1 to 12 and PSO 1 to 4	CO5: Lower Botany.	**SOs 1-5**	4	Introduction to Lower Botany; Algae, Fungi, Bacteria, Virus; Bryophyte; Pteridophyte; Scope/Application of Biology.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54MS126-B
Course Title :	Elementary Mathematics
Pre- requisite:	Students should have basic knowledge of whole numbers, counting, place value, rounding, exponents, and negative numbers; addition and subtraction; and multiplication and division
Rationale:	Upon completion of the course the student shall be able to:- 1. Know the theory and their application in food technology 2. Solve the different types of problems by applying theory 3. Appreciate the important application of mathematics in food technology.

Course Outcomes (CO):

Course Code	Course Outcomes
54MS126-B.1	Apply mathematical concepts and principles to perform computations for food Sciences.
54MS126-B.2	Create, use and analyze mathematical representations and mathematical relationships
54MS126-B.3	Communicate mathematical knowledge and understanding to help in the field of technology in food.
54MS126-B.4	Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.
54MS126-B.5	Distinguish between linear, nonlinear, partial and ordinary differential equations.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54MS126-B	Elementary Mathematics	2	0	1	1	4	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54MS 126-B	Elementary Mathematics	15	15	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS126-B.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1 quadratic equation SO2 Polynomial, Rational fractions SO3Understand the logarithms SO4Understand the Definition of limit of a function		1 -Quadratic equations, nature of the roots. Introduction, 2-Polynomial, Rational fractions Proper and Improper fractions, 3-Partial fraction Application of Partial Fraction . 4- Introduction, Definition, Theorems/Properties of logarithms ,Common logarithms 5-logrithmic problem 6- Real Valued function, Classification of real valued functions,Introduction , Limit of a function Definition of limit of a function	Limit of a function

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS126-B.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO1: Matrices,Types of matrices SO2: Solution of system of linear of equations using matrix method SO3:Product of determinants, Minors and co-Factors		1- Introduction matrices,Types of matrices, Operation on matrices, 2- Matrix Multiplication Solution of system of linear of equations using matrix method 3- Cayley–Hamilton theorem Application of Matrices in solving equations 4- Introduction of Determinants, 5- Properties of determinants 6- Product of determinants, Minors and co-Factors	1- Study the Application of Matrices in solving Pharmacokinetic equations.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS126-B.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO1: Derivative of the sum or difference of two functions **SO2:** Conditions for a function to be amaximum or a minimum at a point. **SO3:** Derivative of x^n *w.r.t*x , Derivative of e^x		1- Introductions, Derivative of a function, Derivative of a constant 2- Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions 3- Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) 4-Derivative of x^n *w.r.t*x , Derivative of e^x, 5-Derivative of $\log_e x$ Derivative of a^x Derivative of trigonometric functions from first principles 6-Problems on differentiations	1- Derivative of a function

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS126-B.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO1– Trignometric formulae SO2 Trigonometric functions SO3: height and distance		1-Signs of the Coordinates, 2- Distance formula, 3-Trignometry 4- basic formulae 5- height and distance 6- Method of substitution Method of Partial fractions Integration by parts, definite integrals, application.	1- Slope or gradient of a straight line.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS126-B.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO1: to know differentiation SO2: formaule and rule of differentiation. SO3: problem base on differentiation.		1- definition of integration 2- formuale of integration 3- integration by substitution method 4- integration by parts 5- definite integral with properties-1 6- definite integral with properties-2	1- Understanding the concept of integration.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54MS126-B -1: Apply mathematical concepts and principles of basic mathematics to perform computations for food science.	6	0	1	1	12
54MS126-B-2:Communicate mathematical knowledge and understanding matrics to help in the field of food technology.	6	0	1	1	12
54MS126-B -3:Communicate mathematical knowledge and understanding trigonometry in to help in the field of food technology.	6	0	1	1	12
54MS126-B - 4: Explain the relationship between the derivative of a function as a function and the notion of the derivative.	6	0	1	1	12
54MS126-B-5: understanding the concept of indefinite and definite integral with problems.	6	0	1	1	12
Total Hours	30	00	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	1. Partial fraction 2. Logarithms 3. quadratic equation 4. coordinate geometry.	03	02	01	06
CO-2	Matrices and Determinant	02	05	03	10
CO-3	Trignometry	02	05	05	12
CO-4	Differentiation	03	04	03	10
CO-5	Integrals : Indefinite and definite	03	04	05	12
Total		13	20	17	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Elementary Mathematics will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S.No.	Title	Author	Publisher	Edition & Year
1	Differential Calculus	Shanti Narayan	S Chand	Fifteenth edition (1 January 1942)
2	Higher Engineering Mathematics	Dr.B.S.Grewal	KHANNA PUBLISHERS	43rd Edition 2015
3	Integral Calculus	Shanthinarayan ,	S Chand	35th Edition
4	Remedial mathematics	Kumar and goyal Dr. Vinod bais	S Vikas and Company	2017

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54MS126-B
Course Title: Elementary Mathematics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Apply mathematical concepts and principles of basic mathematics to perform computations for food science.	3	1	1	1	2	3	3	2	3	3	2	3	3	3	3	3
CO2 Communicate mathematical knowledge and understanding matrics to help in the field of food technology.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO3 mathematical	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3

knowledge and understanding trigonometry in to help in the field of food technology.																
CO4 Explain the relationship between the derivative of a function as a function and the notion of the derivative.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO5 Understanding the concept of indefinite and definite integral with problems.	3	2	1	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Apply mathematical concepts and principles of basic mathematics to perform computations for food science.	**SOs 1-5**	0	Algebra; Theory of quadratic equations, Binomial theorem (for positive integral index only). Uses of Natural and Common Logarithms, Exponential series, Partial Fractions, Determinants (of order three only),	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Communicate mathematical knowledge and understanding matrics to help in the field of food technology.	**SOs 1-5**	0	Theory of Matrices (Addition, Subtraction), Product of Matrices, Transpose, Elementary idea of following: adjoint, Inverse of matrices by adjoint method, Solution of linear equations, Solution of inequalities, Permutation and combination;	
PO 1 to 12 and PSO 1 to 4	CO3: mathematical knowledge and understanding trigonometry in to help in the field of food technology.	**SOs 1-5**	0	Trigonometry; Trigonometry functions, addition and subtraction formula, Double and half angle formula, Laws of sines and cosines, Solution of triangles, Height and distances, Real and complex numbers,	
PO 1 to 12 and PSO 1 to 4	CO4: Explain the relationship between the derivative of a function as a function and the notion of the derivative.	**SOs 1-5**	0	Hyperbolic trigonometric functions, De – Moviers theorem; Coordinate Geometry; Distance between two points, Area of triangles, Straight lines (Parallel and at right angles);	
PO 1 to 12 and PSO 1 to 4	CO5: Understanding the concept of indefinite and definite integral with problems.	**SOs 1-5**	0	Calculus; Elementary Differentiation and Integration.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54PH123
Course Title :	Engineering Physics
Pre- requisite:	Students should be familiar with the fundamentals of Surface Tension, Viscosity, Interference, Application of Interference (Newtons Ring & Michelson Interferometer), Diffraction (Fresnel & Fraunhofer), Types of Diffraction (Single Slit, Double Slit & n-slit), Polarization, Double Reflection, Methods of Polarization, Brewster's law, double refraction, Nicol prism, Quarter and half wave plate, specific rotation, &Half shade polarimeter.
Rationale:	Food science and technology generally consists of the production, preservation and consumption of food.Physics, as a scientific subject, helps to explain and understand the underlying physical and chemical processes that occur during the aforementioned processes. Without physics, we as food scientists/engineers wouldn't understand concepts such as heat transfer, rheology (study of food deformation), thermodynamics, transport phenomena and food spectroscopy.In summary, physics plays an important role in food science and technology by helping to understand and control the physical and chemical processes that occur during food production, preservation, and consumption, which allows food scientists to make better quality and safe food products.

Course Outcomes (CO):

Course Code	Course Outcomes
54PH123.1	Through this chapter students correlate the property of surface tension with different natural phenomena. Students understand the concept of capillarity in liquids. They are able to relate surface tension and capillarity.
54PH123.2	Understand the properties of light like, Interference, Principle of Superposition & Application of Interference.
54PH123.3	Acquire skills to identify and apply formulas of diffraction, type of diffraction and its application.
54PH123.4	Understand the applications of polarization in design and working of Nicol Prism.
54PH123.5	Gain knowledge on working of solid state & Gas LASER and their applications in various fields.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54PH123	Engineering Physics	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54PH 123	Engineering Physics	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54PH123.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO 1.1 Surface tension SO 1.2 Angle of contact SO 1.3 Excess of pressure inside a spherical surface, Capilliary rise SO 1.4 Determination of surface tension by Jaeger's methods,Viscosity (tream line and turbulent motion), SO 1.5 Coefficient of viscosity, Critical velocity),Poieseulle's equation for flow of liquid through a tube	1- Experimental Analysis of capilarry rise method 2- Determination of surface tension by Jaeger's methods	1-Distinguesh between Calssical Waves and Mechanical Waves 2-Experimental explanation about excess of pressure inside a spherical surface,Experimental explanation about Capilliary rise Method 3-Experimental explanation about dynamics of simple harmonic motion 4-Mathematical explanation of surface tension by Jaeger's methods 5-Mathematical explanation of Viscosity(Stream line and turbulent motion, Coefficient of viscosity, Critical velocity) 6-Mathematical Explanation about Poieseulle's equation	1: Expalnation about surface tension

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54PH123.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO 2.1 Principle of superposition SO 2.2 Coherent and non-coherent sources SO 2.3 Concept of interference SO 2.4 Interference from parallel thin film SO 2.5 Newton's ring SO 2.6 Michelson's interferometer	1-To determine the wavelength of Sodium light by using Newtons Ring Experiment 2-To determine the wavelength of He-Ne Laser by using Michelson Interferometer Experiment	2.1: Elementary Proof of Principle of superposition 2.2 Distinguish between Coherent and non-coherent sources 2.3: Experimental explanation about Concept of interference 2.4: Experimental explanation Interference from parallel thin film 2.5: Experimental explanation about Newton's ring 2.6: Mathematical explanationof Michelson's interferometer	1: Explain about principle of superposition

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54PH123.3:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-3**	**Self Learning (SL)**
SO 3.1 Fresnel and Fraunhoffer diffraction SO 3.2 diffraction at a straight edge SO 3.3 Single slit Fraunhoffer diffraction SO 3.4 Double slit and n-Slit Fraunhoffer diffraction SO 3.5 Diffraction grating SO 3.6 Rayleigh's criterion SO 3.7 Resolving power of prism and grating	1-To study the intensity distribution due to diffraction from single slit and 2-To calculate the wavelength of the other prominent lines of mercury by normal incidence method.	1- Elementary Proof of Fresnel and Fraunhoffer diffraction 2- Explain the diffraction at a straight edge 3- Explain about Single slit Fraunhoffer diffraction 4- Describe Double slit and n-Slit Fraunhoffer diffraction 5- Diffraction grating Experimental explanation about Rayleigh's criterion 6-Mathematical & Experimental explanation about resolving power of prism and grating	1 Mathematical & Experimental explanation of Fresnel's& Fraunhofer Diffraction

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54PH123.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO 4.1 Introduction of polarization SO 4.2 production of plane polarized light by different method SO 4.3 Brewster's law,Double refraction,Nicol prism SO 4.4 Quarter and half wave plate SO 4.5 specific rotation Half shade polarimeter	1-To determine the wavelength of monochromatic light by using Fresnel's& Fraunhofer Diffraction Method 2-To determine the double refraction by using Nicol Prism	1- Distinguish between ordinary light &polarized light 2- Mathematical & Experimental method to explain about the production of plane polarized light by different method to Double Slit 3-Experimental analysis about Brewster's law. 4- Explain Double Refraction 5- Construction and working of Nicol prism 6- Mathematical explanation about Quarter and half wave plate Explain about Specific rotation.	1- Mathematical & Experimental explanation of Double Refraction

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54PH123.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO 5.1 Introduction and characteristics of Laser SO 5.2 Spontaneous Emission & Stimulated Emission SO 5.3 Pumping & Population Inversion SO 5.4 Principle of laser SO 5.5 Einstein's coefficients SO 5.6 Principle and working of He-Ne laser with energy level diagram SO 5.7 Principle and working of Ruby Laser laser with energy level diagram SO 5.8 Applications and uses of laser	1-Study on Applications and uses of laser Study on Laser 2-application in food industry	Elementary idea of Laser Production 5.2 Distinguish between Spontaneous Emission & Stimulated Emission 5.3 Distinguish between Pumping & Population Inversion, Components of laser 5.4 Mathematical proof of Einstein's Coefficients 5.5 Explain construction & working of He-Ne Lasers 5.6Explain construction & working of Ruby Lasers, Medical, Industrials, Educationals & Astronomical Applications of Lasers	1-Experimental explanation of Einstein's coefficients Mathematical & Experimental explanation of Solid State & Gas Laser

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54PH123.1: Through this chapter students correlate the property of surface tension with different natural phenomena. Students understand the concept of capillarity in liquids. They are able to relate surface tension and capillarity.	6	4	1	1	12
54PH123.2: Understand the properties of light like, Interference, Principle of Superposition & Application of Interference.	6	4	1	1	12
54PH123.3: Acquire skills to identify and apply formulas of diffraction, type of diffraction and its application.	6	4	1	1	12
54PH123.4: Understand the applications of polarization in design and working of Nicol Prism.	6	4	1	1	12
54PH123.5: Gain knowledge on working of solid state & Gas LASER and their applications in various fields.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Surface tension and viscosity	03	01	01	05
CO-2	Interference	02	06	02	10
CO-3	Diffraction	03	07	05	15
CO-4	Polarization	04	06	05	15
CO-5	Lasers	03	01	01	05
Total		15	21	14	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Engineering Physics will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Physics	A.B. Bhattacharya	Khanna Publishing House, 2020	Revised edition21edition2020
2	Physics for Engineers	N.K. Verma	Prentice Hall India	2017
3	Physics of Vibrations and Waves	H.J.Pain	NationalCouncil forCementandBuildingMaterials	5th Edition, Wiley, 2006
4	Optics	Ajoy Ghatak	McGraw Hill Education India,	2017

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54PH123
Course Title: Engineering Physics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Through this chapter students correlate the property of surface tension with different natural phenomena. Students understand the concept of capillarity in liquids. They are able to relate surface tension		1	2	2	3	2	3	2	2	1	3	2	3	3	3	2

and capillarity.																
CO2 Understand the properties of light like, Interference, Principle of Superposition & Application of Interference.		2	2	2	1	2	3	2	2	1	2	2	2	2	2	1
CO3 Acquire skills to identify and apply formulas of diffraction, type of diffraction and its application.		2	1	1	1	2	2	2	1	2	2	2	1	1	2	2
CO4 Understand the applications of polarization in design and working of Nicol Prism.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5 Gain knowledge on working of solid state & Gas LASER and their applications in various fields.	2	1	2	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Through this chapter students correlate the property of surface tension with different natural phenomena. Students understand the concept of capillarity in liquids. They are able to relate surface tension and capillarity.	**SOs 1-5**	4	Surface tension; Angle of contact, Excess of pressure inside a spherical surface, Capilliary rise, Determination of surface tension by Jaeger's methods; Viscosity; Stream line and turbulent motion, Coefficient of viscosity, Critical velocity, Poieseulle's equation for flow of liquid through a tube.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Understand the properties of light like, Interference, Principle of Superposition & Application of Interference.	**SOs 1-5**	4	Principle of superposition, coherent and non coherent sources, concept of interference, Interference from parallel thin film, Newton's ring and Michelson's interferometer.	
PO 1 to 12 and PSO 1 to 4	CO3: Acquire skills to identify and apply formulas of diffraction, type of diffraction and its application.	**SOs 1-5**	4	Fresnel and Fraunhoffer diffraction , diffraction at a straight edge, single slit , double slit and n-Slit Fraunhoffer diffraction, Diffraction grating, Rayleigh's criterion, resolving power of prism and grating.	
PO 1 to 12 and PSO 1 to 4	CO4: Understand the applications of polarization in design and working of Nicol Prism.	**SOs 1-5**	4	Introduction of polarization, production of plane polarized light by different method, Brewster's law, double refraction, Nicol prism, Quarter and half wave plate, specific rotation, Half shade polarimeter.	
PO 1 to 12 and PSO 1 to 4	CO5: Gain knowledge on working of solid state & Gas LASER and their applications in various fields.	**SOs 1-5**	4	Introduction and characteristics of Laser, Absorption, Spontaneous and Stimulated emission, pumping, population Inversion, Principle of laser, Einstein's coefficients , principle and working of He-Ne laser & Ruby Laser with energy level diagram, applications and uses of laser.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54FT130
Course Title :	Introduction to Food Science andTechnology
Pre- requisite:	Student should have basic knowledge about Food, Nutrition composition and differentfood plant.
Rationale:	The students studying food technology should possess foundational understanding about historical Status of food. This encompasses familiarity with the invention and evolution of food. Additionally, students ought to acquire fundamental insights into various food nutrition, their applications, as well as the Indian regulatory authorities responsible for supervising production standards and quality of food.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT130.1	Overview of basic definition of food science, food technology and evolution of food along with its nutritional values.
54FT130.2	Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.
54FT130.3	Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.
54FT130.4	Explain the concept of importance of food preservation along with its different types.
54FT130.5	Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT130	Introduction to Food Science andTechnology	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT130	Introduction to Food Science andTechnology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the Introduction, Definition,History, Evolution, Human DigestiveSystem, **SO1.2** Understand the Nutritional aspect of Food and importance of Food Technology, **SO1.3** Understand the Global Productionstatus of Food Raw Materials. **SO1.4** Understand the Various classification of Food Industry, constituents of food, major Food quality Parameters. **SO1.5** Understand the Role of Microbiology, Biochemistry, **SO1.6** Nutritional Sciences and Neurochemistry in Food quality evaluation	**1-**Introduction about different types of equipment that used in Food quality lab **2-**Introduction about different types of equipment that used in food Process engineering lab	1-Basic definition regarding to food technology. 2-Nutritional aspect of Food. 3-Global Production status of Food. 4-Food Industry and there location. 5- Role of Microbiology, Biochemistry 6- Basics of Nutritional Sciences and Neurochemistry in Food quality evaluation	1-Knowledge about balance diet as per WHO for gaining of complete Food nutrition.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the History of food processing machinery SO2.2 Understand the History of food processing method SO2.3 Understand the Introduction and definition of the Major Unit operations SO2.4 Understand the Major Food Process Equipments used after harvesting the various crops, i.e. cereal, SO2.5 Understand the Major Food Process Equipments used after harvesting the pulses, oilseeds , SO2.6 Understand the Major Food Process Equipments used after harvesting the fruits, vegetables, plantation and spice crops.	1-Introduction about different engineering properties of food 2- Study on various post harvest machinery about different unit operation in food. about different unit operation in food. about different unit operation in food. about different unit operation in food. about different unit operation in food.	1-History of food processing, food processing method. 2-Major Unit operations. 3-Major Food Process Equipments used after harvesting. 4-Cereal crop processing method and machinery 5- Pulses and oilseed crop processing method and machinery 6-Fruits,vegetable and plantation crop processing machinery	1-Knowledge about Food processing machinery. operation in food.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the Introduction to the basic technical terms used in Food Processing calculations. SO3.2 Understand the Heat, Calorific value, Enthalpy, Specific heat, Thermal conductivity, Relative Humidity. SO3.3 Understand the Latent Heat and Sensible heat. Basic conversion used in energy calculations i.e. Calories, Joule, Watt. SO3.4 Understand the Horse Power, Electricity consumption measurement in food processing equipment and machinery. SO3.5 Understand the mode of Heat Transfer, SO3.6 Acquire the knowledge about Application of steam and heating element in food industry.	1-Study on Specific heat of different cereal grain 2-To study about thermal properties of grain	1-Introduction to the basic technical terms. Food Processing 2-Introduction to Heat Introduction thermal properties of food 3-Basic conversion used in energy calculations 4-Horse Power, Electricity consumption 5-Mode of Heat Transfer 6- Application of steam and heating element in food industry	1-Knowledge about various mode of heat transfer in food plant.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the Definition and importance of Food Preservation. SO4.2 Understand the Different methods of FoodPreservation. SO4.3 Understand the Differences in Traditional and Modern method. SO4.4 Understand the Shelf Life of food material and their assessment. SO4.5 Understand the Deteriorative factors Acquire the knowledge about and their control.	1-To study about thermal methods of food preservation 2-Estimationof shelf lifeof various Food materials	1-Food preservation Importance of Food Preservation 2-Methods of Food Preservation 3-Differences in Traditional and Modern method. 4-Shelf Life of food material 5-Assessment of spoilage level 6-Deteriorative factors and their control	1- Knowledge about various food preservation techniques

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1 Understand the Food storage principles SO5.2 Understand the methods and structures of cereals, pulses, oilseed, fruits, vegetables, tea, coffee, cocoa bean, spices and other crop during storage SO5.3 Understand the Major variables causes deterioration and changes in crop during storage. SO5.4 Understand the Technical aspect and importance of food packaging and different packaging materials used in food packaging. SO5.5 Understand the Role of Packaging in sales, marketing and distribution of food products.	1.To study about different types o grain Storage structures 2. To study about different functions of packaging	1- Food storage principles, methods and structures of cereals, pulses, 2- Food storage principles, methods and structures of oilseed, 3- Food storage principles, methods and structures of fruits, vegetables, 4- Food storage principles, methods and structures of tea, coffee,cocoa bean, 5- Food storage principles, methods and structures of spices and other crop during storage. 6- Major variables causes deterioration and changes in crop during storage. Technical aspect and importance of food packaging and different packaging materials used in food packaging. Role of Packaging in sales, marketing and distribution of food products.	1. Knowledge of grain silo for storing of grain.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT130.1: Overview of basic definition of food science, food technology and evolution of food along with its nutritional values	6	4	1	1	12
54FT130.2: Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.	6	4	1	1	12
54FT130.3: Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.	6	4	1	1	12
54FT130.4: Explain the concept of importance of food preservation along with its different types	6	4	1	1	12
54FT130.5: Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Overview of food science and food technology.	03	03	01	07
CO-2	Different types of unit operations along with their equipments.	03	05	02	10
CO-3	Basic technical terms that used in food technology.	02	06	03	11
CO-4	Food preservation and its method.	03	04	04	11
CO-5	Grain storage and food packaging.	02	04	05	11
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Introduction to Food Science and Technology will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S.No.	Title	Author	Publisher	Edition & Year
1	Unit Operations of Agricultural Processing	K.M. Sahay & K.K.Singh	Vikash Publishing House,Ne w Delhi	2015, 2nd
2	Fundamentals of Food Processing	Heid, J.L. and Joslyn, M.A	AVI Publishing Co; Westport	1967
3	Food Process Engineering Operation	Heldman, D.R	TheAVI Publishing Co; Westport	1975
4	Food Preservation & Processing	Manoranjan Kalia And Sangita Sood.	Kalyani Publication, New Delhi	

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT130
Course Title: Introduction to Food Science and Technology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Overview of food science and food technology.	2	2	3	1	1	3	2	3	1	3	1	1	3	3	3	3
CO2 Different types of unit operations along with their equipments.	3	3	2	1	3	1	3	1	2	1	1	1	3	3	3	3
CO3 Basic technical terms that used in food technology.	3	3	1	2	3	1	1	1	2	2	1	3	3	2	1	1
CO4 Food preservation and	3	1	3	1	3	1	3	1	2	3	1	3	1	1	3	1

its method.																
CO5 Grain storage and food packaging.	3	1	2	1	3	1	2	3	2	2	1	1	3	1	3	1

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Overview of basic definition of food science, food technology and evolution of food along with its nutritional values.	**SOs 1-5**	4	Basic definition regarding to food technology, Nutritional aspect of Food Global Production status of Food Industry and there location Nutritional Sciences and Neurochemistry in Food quality evaluation	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.	**SOs 1-5**	4	History of food processing food processing method Major Unit operations Major Food Process Equipments used after harvesting	
PO 1 to 12 and PSO 1 to 4	CO3: Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.	**SOs 1-5**	4	Introduction to the basic technical terms Food Processing Introduction to Heat Introduction thermal properties of food Basic conversion used in energy calculations Horse Power, Electricity consumption mode of Heat Transfer Application of steam and heating element in food industry.	
PO 1 to 12 and PSO 1 to 4	CO4: Explain the concept of importance of food preservation along with its different types	**SOs 1-5**	4	Importance of food preservation along with its different types Importance of Food Preservation methods of Food Preservation Differences in Traditional and Modern method. Shelf Life of food material Assessment of spoilage level Deteriorative factors and their control	
PO 1 to 12 and PSO 1 to 4	CO5: Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product	**SOs 1-5**	4	Food storage principles methods and structures of cereals, pulses, oilseed, fruits, vegetables, tea, coffee, cocoa bean, spices and other crop during storage. Major variables causes deterioration changes in crop during storage Technical aspect and importance of food packaging Role of Packaging in sales, marketing and distribution of food	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54EV129
Course Title :	Environmental Sciences & Disaster Management
Pre- requisite:	Students should have basic knowledge about different natural phenomena that related with ecology and ecosystem of the nature.
Rationale:	The students studying i.e. Environmental Sciences & Disaster Management is a branch of science that deals with interaction about different natural aspect such as ecology and ecosystem as well as, different natural issues that will occur due to environmental pollution and there management . This Subject also comprises about disaster management which is applicable for rectify the issues of pollution and to overcome the problem of environment degradation (Biodiversity).

Course Outcomes (CO):

Course Code	Course Outcomes
54EV129.1	To overview of environment science and impact of technology on environment and ecosystem also.
54EV129.2	To explain about different natural resources such as water resources, forest resources and Energy resources.
54EV129.3	To acquired the knowledge of different types of pollution.
54EV129.4	To explain about Current environmental global issues
54EV129.5	To explain about Definition, concept and types of disaster management, as well as Role of NGOs

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54EV129	Environmental Sciences & Disaster Management	1	2	1	1	5	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54EV 129	Environmental Sciences & Disaster Management	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EV129.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand the Environment, ecology and ecosystem: Impact of technology on the environment SO1.2 Understand the concept ,structure and function of ecosystem; Bio-geo-chemical cycles: SO1.3 Understand the Energy flow in eco-system; Food chains:, food webs; Ecological pyramids; Major ecosystems	1. Visit to local polluted sites and collection of water/soil sample. 2. Determination of total dissolved solids (TDS) and total solid (TS) in effluents/water.	**<u>Unit 1</u>** 1.1Environment, ecology and ecosystem 1.2 function of ecosystem; Bio-geo-chemical 1.3 Food chains, food webs	Knowledge about ecosystem in detail.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EV129.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand the Natural resources; Water resources; SO2.1 Understand the Forest resources: uses of forest SO2.1 Understand the Deforestations: Causes and effects, Energy resources	1. Determination of hardness in given water sample. 2. Determination of alkalinity in given water sample	**<u>Unit 2</u>** 2.1 Natural resources; Water resources; 2.2 Forest resources 2.3 Deforestations: Causes and effects	1. Knowledge about Deforestation.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EV129.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand the Environmental pollution - Water pollution SO3.2 Understand the Air pollution:, ambient air quality standards,; soil and noise pollution SO3.3 Understand the Radioactive pollution; Control of environmental pollution through law;	1. Determination of acidity in given water sample. 2. Determination of dissolved oxygen (DO) in given water sample	**<u>Unit 3</u>** 3.1 Environmental pollution. 3.2 Air pollution:, ambient air quality standards. 3.3Radioactive pollution.	Knowledge about Control of environmental pollution

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EV129.4

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Understand the Current environmental global issues: SO4.2 Understand the Global warming and green houses effects, acid rain, depletion of ozone layer. SO4.3 Understand the Population and pollution, reasons for overpopulation, population growth	1. Identification of plant species in university campus. 2. Determination of soil moisture content in given soil sample.	**<u>Unit 4</u>** 4.1 Current environmental global issues 4.2 Global warming and green houses effects 4.3 pollution, reasons for overpopulation	Knowledge about green house effect.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EV129.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand the Definition, types of disaster, Floods, cyclone, earthquakes, drought etc. SO5.2 Understand the Forest fires, pollutions. Disaster Management-international Strategy, SO5.3 Understand the National Disaster Management Frame work, Role of NGOs. Armed forces in Disaster response.	. 1. Determination of carbonate content in given soil sample. 2. Determination of nitrate content in given soil sample.	**Unit 5** 5.1 Definition, types of disaster, Floods, cyclone, earthquakes, drought 5.2 Disaster Management-international Strategy, 5.3 National Disaster Management Frame work	Knowledge about Role of NGOs. Armed forces in Disaster response.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54EV129.1: To overview of environment science and impact of technology on environment and ecosystem also.	3	4	1	1	09
54EV129.2: To explain about different natural resources such as water resources, forest resources and Energy resources.	3	4	1	1	09
54EV129.3: To acquired the knowledge of different types of pollution	3	4	1	1	09
54EV129.4: To explain about Current environmental global issues	3	4	1	1	09
54EV129.5: To explain about Definition, concept and types of disaster management, as well as Role of NGOs	3	4	1	1	09
Total Hours	15	20	5	5	45

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Concept of environment science and impact of technology on environment and ecosystem also.	03	03	01	07
CO-2	Brief description about different natural resources such as water resources, forest resources and Energy resources.	03	05	02	10
CO-3	Acquired the knowledge of different types of pollution	02	06	03	11
CO-4	Current environmental global issues	03	04	04	11
CO-5	Types of disaster management, as well as Role of NGOs	02	04	05	11
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Environmental Sciences & Disaster Management will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Introduction to Environmental Engineering and Science.	Gilbert M. Masters and Wendell P. Ela	Science. Pearson Education Limited, NY, USA	2013
2	Environmental Engineering and Management	Suresh K. Dhameja	S. K. Kataria & Sons, New Delhi.	2009
3	Environmental Science	Bernard J. Nebel and Richard T. Wright	. Prentice-Hall Professional, New Delhi.	1993

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AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54EV129
Course Title: Environmental Sciences & Disaster Management

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Concept of environment science and impact of technology on environment and ecosystem also.	1	2	3	1	1	3	2	3	3	3	1	2	3	3	3	3
CO2 Brief description about different natural resources such as water resources, forest resources and	1	3	2	1	3	3	2	1	2	1	1	1	3	3	3	3

Energy resources.																
CO3 Acquired the knowledge of different types of pollution	1	3	1	1	3	2	1	1	2	2	2	3	3	3	3	3
CO4 Current environmental global issues	1	1	2	1	3	2	3	1	3	3	1	3	3	3	3	3
CO5 Types of disaster management, as well as Role of NGOs	1	2	2	2	3	2	2	3	2	2	1	1	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: To overview of environment science and impact of technology on environment and ecosystem also.	**SOs 1-5**	4	Environment, ecology and ecosystem function of ecosystem; Bio-geo-chemical Food chains, food webs	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: To explain about different natural resources such as water resources, forest resources and Energy resources.	**SOs 1-5**	4	Natural resources; Water resources; Forest resources, Deforestations: Causes and effects	
PO 1 to 12 and PSO 1 to 4	CO3: To acquired the knowledge of different types of pollution	**SOs 1-5**	4	Environmental pollution. Air pollution:, ambient air quality standards. Radioactive pollution.	
PO 1 to 12 and PSO 1 to 4	CO4: To explain about Current environmental global issues	**SOs 1-5**	4	Current environmental global issues Global warming and green houses effects pollution, reasons for overpopulation	
PO 1 to 12 and PSO 1 to 4	CO5: To explain about Definition, concept and types of disaster management, as well as Role of NGOs	**SOs 1-5**	4	Definition, types of disaster, Floods, cyclone, earthquakes, drought Disaster Management- international Strategy, National Disaster Management Frame work	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54MB122
Course Title :	General Microbiology
Pre- requisite:	Students should have basic knowledge of various metabolisms of Human body and nutritional demand.
Rationale:	The students studying General Microbiology i.e. a scientific discipline that focuses on the examination of microscopic organisms, which are too small to be observed without the aid of magnification. The field is concerned with the function, structure, and classification of these organisms. Microorganisms play a crucial role in our daily lives, as they are intricately interconnected with various aspects of our existence.

Course Outcomes (CO):

Course Code	Course Outcomes
54MB122.1	Describe diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism, and the ways to control their growth by physical and chemical means
54MB122.2	Explain the basic genetic systems of bacteria, bacteriophage and plasmids
54MB122.3	Acquired the knowledge for operating Microscope.
54MB122.4	Explain the role of microorganisms in food production and preservation, and their ability to cause food-borne infections
54MB122.5	Demonstrate practical skills in fundamental microbiological techniques.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54MB122	General Microbiology	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54MB122	General Microbiology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MB122.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand Evolution and scope of microbiology SO1.2 Understand History of microbiology SO1.3 Understanding the Microbial classification SO1.4 Understanding the Nomenclature and identification SO1.5 Understanding the Taxonomic groupings.	1. Introduction to Food Quality and Analysis Laboratory 2 Introduction to Microbial Safety at Laboratory	1.Evolution of microbiology 2.Scope of microbiology 3.History of microbiology 4.Microbial classification 5.Nomenclature and identification 6.Taxonomic groups	Knowledge about various Microbes and their historical interventions

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MB122.2:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-2**	**Self Learning (SL)**
SO2.1 Understand methods of classifying bacteria SO2.2 Understand Microscopy and microscopes SO2.3 Understanding Morphology and fine structure of bacteria SO2.4 Understanding Nutritional classification of bacteria SO2.5 Understanding Growth and Reproduction of bacteria.	1. Introduction to instruments at FATL 2. Introduction to Microbial Media for Bacteria	1. General methods of classifying bacteria 2. Microscopy and microscopes: Smears and staining 3. Morphology and fine structure of bacteria 4. Cultivation of bacteria Nutritional requirements; Nutritional classification of bacteria. 5. Bacteriological media Growth of bacteria 6. Reproduction of bacteria	Knowledge about various Microscope and types of Microscope

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MB122.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand fungi, algae and protozoa and virus SO3.2 Understand Nutrient transport phenomenon SO3.3 Understanding Microbial genetics SO3.4 Understanding Bacterial conjugation SO3.5 Understanding Bacterial transformation	1. Introduction to instruments at FATL 2. Introduction to Microbial Media for Fungi	1.Introduction to fungi, algae 2.protozoa and virus 3.Nutrient transport phenomenon: Passive diffusion, facilitated diffusion; 4.Group translocation, active transport 5.Microbial genetics; Bacterial recombination; 6.Bacterial conjugation, transduction, Bacterial transformation	Knowledge about various Microbes and their nutritional requirement

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MB122.4

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understand Mutation and its types SO4.2 Understand Mutagenesis SO4.3 Understanding Designation of bacterial mutants SO4.4 Understanding Destruction of microorganisms SO4.5 Understanding Chemotherapeutic agents and chemotherapy.	1. Introduction to instruments at FATL 2. Inoculation and incubation to Fungi from FATL	1. Mutations: Types of mutations, 2. Mutagenesis; Mutation rate, repair of mutations; Phenotypes of bacterial mutants; 3. Designation of bacterial mutants 4. Destruction of microorganisms: Physical agents and chemical agents 5. Chemotherapeutic agents and chemotherapy; 6.Characteristics of antibiotics; Mode of action of antibiotics	Knowledge about various Mutation and its repair

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MB122.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Inoculation and Incubation SO5.2 Understand Methods of Pure Cultural Techniques SO5.3 Understanding types of Plating SO5.4 Understanding Preservation of Microbes SO5.5 Understanding Culture Cryopreservation	LI5.1. Introduction to instruments at FATL LI5.2. Introduction to selective Media for Pure Culture.	1. Pure culture 2.1 Methods of isolation of pure cultures 2.2 Methods of isolation of pure cultures 3.1 Maintenance and preservation of pure cultures 3.2 Maintenance and preservation of pure cultures 4. Culture collections	Knowledge about various techniques of Pure Culture

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54MB122.1: Describe diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism, and the ways to control their growth by physical and chemical means	6	4	1	1	12
54MB122.2: Explain the basic genetic systems of bacteria, bacteriophage and plasmids	6	4	1	1	12
54MB122.3: Acquired the knowledge for operating Microscope.	6	4	1	1	12
54MB122.4: Explain the role of microorganisms in food production and preservation, and their ability to cause food-borne infections	6	4	1	1	12
54MB122.5: Demonstrate practical skills in fundamental microbiological techniques.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Historical Overview of Classified Microbes	03	02	01	06
CO-2	Microscope and Nutritional Classification of Bacteria	03	05	03	11
CO-3	Nutrient Transport in Microbes	03	05	03	11
CO-4	Mutation and antibiotics	03	05	03	11
CO-5	Pure Culture and Culture Collection	03	03	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for General Microbiology will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Microbiology: An Introduction	Gerard J. Tortora, Berdell R. Funke, Christine L. Case	Prentice-Hall, NY, USA	2014., 12th Ed
2	Prescott's Microbiology	Johanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton	McGraw-Hill Higher Education, NY, USA	2013., 9th Ed
3	Microbiology	Michael J. Pelczar Jr., E.C.S. Chan and Noel R. Krieg	McGraw-Hill Education, New Delhi	1998., 5th Ed. Tata
4	Textbook of Food Microbiology	Virendra Kumar Pandey	ISC Bangalore, Karnataka	2020, 1st Ed

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54MB122
Course Title: General Microbiology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Historical Overview of Classified Microbes	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2 Microscope and Nutritional Classification of Bacteria	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO3 Nutrient Transport in Microbes	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4 Mutation and antibiotics	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5 Pure Culture and	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Culture Collection																

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Historical Overview of Classified Microbes	**SOs 1-5**	4	Evolution and scope of microbiology; History of microbiology; Microbial classification, nomenclature and identification; Taxonomic groups.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Microscope and Nutritional Classification of Bacteria	**SOs 1-5**	4	General methods of classifying bacteria; Microscopy and microscopes: Smears and staining; Morphology and fine structure of bacteria; Cultivation of bacteria, nutritional requirements; Nutritional classification of bacteria; Bacteriological media, Growth of bacteria, Reproduction of bacteria	
PO 1 to 12 and PSO 1 to 4	CO3: Nutrient Transport in Microbes	**SOs 1-5**	4	Introduction to fungi, algae and protozoa and virus: Nutrient transport phenomenon: Passive diffusion, facilitated diffusion; Group translocation, active transport. Microbial genetics; Bacterial recombination; Bacterial conjugation, transduction; Bacterial transformation.	
PO 1 to 12 and PSO 1 to 4	CO4: Mutation and antibiotics	**SOs 1-5**	4	Mutations: Types of mutations, mutagenesis; Mutation rate, repair of mutations; Phenotypes of bacterial mutants; Designation of bacterial mutants; Destruction of microorganisms: Physical agents and chemical agents; Chemotherapeutic agents and chemotherapy; Characteristics of antibiotics; Mode of action of antibiotics.	
PO 1 to 12 and PSO 1 to 4	CO5: Pure Culture and Culture Collection	**SOs 1-5**	4	Pure culture: Methods of isolation of pure cultures; Maintenance and preservation of pure cultures; Culture collections.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54FT130
Course Title :	Introduction to Food Science andTechnology
Pre- requisite:	Student should have basic knowledge about Food, Nutrition composition and differentfood plant.
Rationale:	The students studying food technology should possess foundational understanding about historical Status of food. This encompasses familiarity with the invention and evolution of food. Additionally, students ought to acquire fundamental insights into various food nutrition, their applications, as well as the Indian regulatory authorities responsible for supervising production standards and quality of food.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT130.1	Overview of basic definition of food science, food technology and evolution of food along with its nutritional values.
54FT130.2	Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.
54FT130.3	Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.
54FT130.4	Explain the concept of importance of food preservation along with its different types.
54FT130.5	Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT130	Introduction to Food Science andTechnology	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT130	Introduction to Food Science andTechnology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the Introduction, Definition,History, Evolution, Human DigestiveSystem, **SO1.2** Understand the Nutritional aspect of Food and importance of Food Technology, **SO1.3** Understand the Global Productionstatus of Food Raw Materials. **SO1.4** Understand the Various classification of Food Industry, constituents of food, major Food quality Parameters. **SO1.5** Understand the Role of Microbiology, Biochemistry, **SO1.6** Nutritional Sciences and Neurochemistry in Food quality evaluation	**1-**Introduction about different types of equipment that used in Food quality lab **2-**Introduction about different types of equipment that used in food Process engineering lab	1-Basic definition regarding to food technology. 2-Nutritional aspect of Food. 3-Global Production status of Food. 4-Food Industry and there location. 5- Role of Microbiology, Biochemistry 6- Basics of Nutritional Sciences and Neurochemistry in Food quality evaluation	1-Knowledge about balance diet as per WHO for gaining of complete Food nutrition.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the History of food processing machinery SO2.2 Understand the History of food processing method SO2.3 Understand the Introduction and definition of the Major Unit operations SO2.4 Understand the Major Food Process Equipments used after harvesting the various crops, i.e. cereal, SO2.5 Understand the Major Food Process Equipments used after harvesting the pulses, oilseeds , SO2.6 Understand the Major Food Process Equipments used after harvesting the fruits, vegetables, plantation and spice crops.	1-Introduction about different engineering properties of food 2- Study on various post harvest machinery about different unit operation in food. about different unit operation in food. about different unit operation in food. about different unit operation in food. about different unit operation in food.	1-History of food processing, food processing method. 2-Major Unit operations. 3-Major Food Process Equipments used after harvesting. 4-Cereal crop processing method and machinery 5- Pulses and oilseed crop processing method and machinery 6-Fruits,vegetable and plantation crop processing machinery	1-Knowledge about Food processing machinery. operation in food.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the Introduction to the basic technical terms used in Food Processing calculations. SO3.2 Understand the Heat, Calorific value, Enthalpy, Specific heat, Thermal conductivity, Relative Humidity. SO3.3 Understand the Latent Heat and Sensible heat. Basic conversion used in energy calculations i.e. Calories, Joule, Watt. SO3.4 Understand the Horse Power, Electricity consumption measurement in food processing equipment and machinery. SO3.5 Understand the mode of Heat Transfer, SO3.6 Acquire the knowledge about Application of steam and heating element in food industry.	1-Study on Specific heat of different cereal grain 2-To study about thermal properties of grain	1-Introduction to the basic technical terms. Food Processing 2-Introduction to Heat Introduction thermal properties of food 3-Basic conversion used in energy calculations 4-Horse Power, Electricity consumption 5-Mode of Heat Transfer 6- Application of steam and heating element in food industry	1-Knowledge about various mode of heat transfer in food plant.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the Definition and importance of Food Preservation. SO4.2 Understand the Different methods of FoodPreservation. SO4.3 Understand the Differences in Traditional and Modern method. SO4.4 Understand the Shelf Life of food material and their assessment. SO4.5 Understand the Deteriorative factors Acquire the knowledge about and their control.	1-To study about thermal methods of food preservation 2-Estimationof shelf lifeof various Food materials	1-Food preservation Importance of Food Preservation 2-Methods of Food Preservation 3-Differences in Traditional and Modern method. 4-Shelf Life of food material 5-Assessment of spoilage level 6-Deteriorative factors and their control	1- Knowledge about various food preservation techniques

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT130.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1 Understand the Food storage principles SO5.2 Understand the methods and structures of cereals, pulses, oilseed, fruits, vegetables, tea, coffee, cocoa bean, spices and other crop during storage SO5.3 Understand the Major variables causes deterioration and changes in crop during storage. SO5.4 Understand the Technical aspect and importance of food packaging and different packaging materials used in food packaging. SO5.5 Understand the Role of Packaging in sales, marketing and distribution of food products.	1.To study about different types o grain Storage structures 2. To study about different functions of packaging	1- Food storage principles, methods and structures of cereals, pulses, 2- Food storage principles, methods and structures of oilseed, 3- Food storage principles, methods and structures of fruits, vegetables, 4- Food storage principles, methods and structures of tea, coffee,cocoa bean, 5- Food storage principles, methods and structures of spices and other crop during storage. 6- Major variables causes deterioration and changes in crop during storage. Technical aspect and importance of food packaging and different packaging materials used in food packaging. Role of Packaging in sales, marketing and distribution of food products.	1. Knowledge of grain silo for storing of grain.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT130.1: Overview of basic definition of food science, food technology and evolution of food along with its nutritional values	6	4	1	1	12
54FT130.2: Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.	6	4	1	1	12
54FT130.3: Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.	6	4	1	1	12
54FT130.4: Explain the concept of importance of food preservation along with its different types	6	4	1	1	12
54FT130.5: Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Overview of food science and food technology.	03	03	01	07
CO-2	Different types of unit operations along with their equipments.	03	05	02	10
CO-3	Basic technical terms that used in food technology.	02	06	03	11
CO-4	Food preservation and its method.	03	04	04	11
CO-5	Grain storage and food packaging.	02	04	05	11
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Introduction to Food Science and Technology will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S.No.	Title	Author	Publisher	Edition & Year
1	Unit Operations of Agricultural Processing	K.M. Sahay & K.K.Singh	Vikash Publishing House,Ne w Delhi	2015, 2nd
2	Fundamentals of Food Processing	Heid, J.L. and Joslyn, M.A	AVI Publishing Co; Westport	1967
3	Food Process Engineering Operation	Heldman, D.R	TheAVI Publishing Co; Westport	1975
4	Food Preservation & Processing	Manoranjan Kalia And Sangita Sood.	Kalyani Publication, New Delhi	

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT130
Course Title: Introduction to Food Science and Technology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Overview of food science and food technology.	2	2	3	1	1	3	2	3	1	3	1	1	3	3	3	3
CO2 Different types of unit operations along with their equipments.	3	3	2	1	3	1	3	1	2	1	1	1	3	3	3	3
CO3 Basic technical terms that used in food technology.	3	3	1	2	3	1	1	1	2	2	1	3	3	2	1	1
CO4 Food preservation and	3	1	3	1	3	1	3	1	2	3	1	3	1	1	3	1

its method.																
CO5 Grain storage and food packaging.	3	1	2	1	3	1	2	3	2	2	1	1	3	1	3	1

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Overview of basic definition of food science, food technology and evolution of food along with its nutritional values.	**SOs 1-5**	4	Basic definition regarding to food technology, Nutritional aspect of Food Global Production status of Food Industry and there location Nutritional Sciences and Neurochemistry in Food quality evaluation	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.	**SOs 1-5**	4	History of food processing food processing method Major Unit operations Major Food Process Equipments used after harvesting	
PO 1 to 12 and PSO 1 to 4	CO3: Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.	**SOs 1-5**	4	Introduction to the basic technical terms Food Processing Introduction to Heat Introduction thermal properties of food Basic conversion used in energy calculations Horse Power, Electricity consumption mode of Heat Transfer Application of steam and heating element in food industry.	
PO 1 to 12 and PSO 1 to 4	CO4: Explain the concept of importance of food preservation along with its different types	**SOs 1-5**	4	Importance of food preservation along with its different types Importance of Food Preservation methods of Food Preservation Differences in Traditional and Modern method. Shelf Life of food material Assessment of spoilage level Deteriorative factors and their control	
PO 1 to 12 and PSO 1 to 4	CO5: Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product	**SOs 1-5**	4	Food storage principles methods and structures of cereals, pulses, oilseed, fruits, vegetables, tea, coffee, cocoa bean, spices and other crop during storage. Major variables causes deterioration changes in crop during storage Technical aspect and importance of food packaging Role of Packaging in sales, marketing and distribution of food	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	SDG-101
Course Title :	Sustainable Development Goals (SDGs)
Pre- requisite:	Student should have basic knowledge of Environment, Natural resources, Climate change and sustainability.
Rationale:	To inculcate the knowledge base on sustainable development with a view to balance our economic, environmental and social needs, allowing prosperity for now and future generations. To train students to undertake major initiatives in the efficient management of natural resources and the prevention of environmental pollution with focus on Sustainable Development. To use environmental management tools that help to improve the quality of environment, to assess local vulnerabilities with respect to climate, natural disasters and to achieve sustainable developmental needs.

Course Outcomes (CO):

Course Code	Course Outcomes
SDG-101.1	Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.
SDG-101.2	Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.
SDG-101.3	Understand the implications of overuse of resources, population growth and economic growth and sustainability and explore the challenges the society faces in making transition to renewable resource use.
SDG-101.4	Develop skills to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development and apply critical thinking skills to evaluate the quality, credibility and limitations of an argument for solution.
SDG-101.5	Describe the steps of the design thinking methodology and how design thinking can accelerate effective SDG implementation. Deepen knowledge and pedagogical tools to incorporate values-based education for sustainable development in educational programmes and processes.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	SDG-101	Sustainable Development Goal	2	0	1	1	4	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	SDG-101	Sustainable Development Goal	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

SDG-101.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1Understand about Sustainable Development SO1.2 Understand the Need and Importance of SDGs SO1.3 Understand the historical evolution of SDGs SO1.4 Gain knowledge of SDGs Different goals and their importance SO1.5 Explain the Challenges & strategies of attaining SDGs in countries.		1.1 Need and Importance of Sustainable Development 1.2 Historical & Policy perspectives of Sustainable Development 1.3 Sustainable Development: World and India Perspective 1.4 Introduction to 17 SDGs 1.5 Specific learning objectives for different SDGs 1.6 Challenges & strategies of attaining SDGs in developed and developing nations	1- Different SDG goals details and its importance

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

SDG-101.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Explain Sustainable Development **SO2.2** Understand the NEP-2020 and SDG **SO2.3** Discuss higher Education role to achieve SDGs **SO2.4** Explain how education for Sustainable Development **SO2.5** Explain the measuring techniques for Sustainability		2.1 Focus of NEP-2020 on SDG 2.2 Education for Sustainable Development (ESD): 2.3 Berlin Declaration 2021 on ESD 2.4 Integration of ESD in curriculum and textbooks 2.5 Tools, Systems, and Innovation for Sustainability 2.6 Measuring Sustainability: How do we measure sustainability	1-Concept, Tools and techniques for measuring sustainability

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

SDG-101.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand current economic issues in the context of the global sustainable development debate. **SO3.2** Outline of health, hygiene and water sanitation issues. **SO3.3** Discuss the renewable energy resources and its importance in present scenario **SO3.4** Explain the importance of sustainable production and consumption **SO3.5** Explain the problems and solution in rural and urban areas.		3.1 Circular economy (basic model of reuse, recycle, and reduce) 3.2 Rural & urban Problems & Challenges 3.3 Sustainable production and consumption 3.4 Renewable energy 3.5 Health & Hygiene, water , sanitation & water management 3.6 Waste Management	1- Water treatment and management practices.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

SDG-101.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand environmental sustainability is crucial in reducing the impacts of climate change **SO4.2** Discuss causes of emission of GHGs and its consequences **SO4.3** Explain how climate change and sustainable development both play a role in shaping the human and environmental factors of the world. **SO4.4** Explain the importance of sustainable production and consumption **SO4.5** Climate change is disrupting national economies and affecting lives and livelihoods, especially for the most vulnerable and its mitigation.		4.1 The greenhouse effect: Causes and Consequences 4.2 Climate Change: A Threat to Sustainable Development 4.3 Adaptation to Current and Future Climate Regimes 4.4 The consequences: crop failure 4.5 Solutions technology and lifestyle changes 4.6 Mitigating Climate Change	1- Agreement on Climate Change, Trade, and Sustainability Carbon Credit, carbon trading

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

SDG-101.5:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO4.1 Understand the relevance and the concept of sustainability and the global initiatives in this direction **SO4.2** Understand role of Corporations and Ecological Sustainability**.** **SO4.3** Explain role of CSR in Sustainability. **SO4.4** Understand the SD challenge for companies, their responsibility and their potentials for action **SO4.5** Discuss the role of world government for world justice and peace		5.1 Corporate Social Responsibility 5.2 Sustainable products and services 5.3 Business and Environment 5.4 Corporations and Ecological Sustainability 5.5 Life Cycle Assessment: • LCA Overview and Application 5.6 World peace and justice: • United nations goals for peace and justice World Government for peace	1-Local to the Global: Can Sustainable Development Work

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
SDG-101.1: Examine critically the 17 newly minted UN Sustainable Development Goals and understand the historical evolution, key theories, and concepts of sustainable development.	6	0	1	1	08
SDG-101.2: Identify and apply methods for assessing the achievement of sustainable development and discover the science, technology, economics, and politics underlying the concepts of sustainability.	6	0	1	1	08
SDG-101.3: Understand the implications of overuse of resources, population growth and economic growth and sustainability and explore the challenges the society faces in making transition to renewable resource use.	6	0	1	1	08
SDG-101.4: Develop skills to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development and apply critical thinking skills to evaluate the quality, credibility	6	0	1	1	08

and limitations of an argument for solution.					
SDG-101.5: Describe the steps of the design thinking methodology and how design thinking can accelerate effective SDG implementation. Deepen knowledge and pedagogical tools to incorporate values-based education for sustainable development in educational programmes and processes.	6	0	1	1	08
Total Hours	30	00	5	5	40

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Need and Importance of Sustainable Development	03	01	01	05
CO-2	Education for Sustainable Development (ESD): Tools, Systems, and Innovation for Sustainability	02	06	02	10
CO-3	Discuss the sustainable production and consumption	03	07	05	15
CO-4	How Climate Change may be Threat to Sustainable Development	-	10	05	15
CO-5	Role of Corporations and Ecological Sustainability	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Sustainable Development Goals (SDGs) will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S.No.	Title	Author	Publisher	Edition & Year
1	The Economics of Sustainable Development: The Case of India (Natural Resource Management and Policy)"	Surender Kumar and Shunsuke Managi	Springer Switzerland	2009
2	Corporate Social Responsibility in Developing and Emerging Markets	Onyeka Osuji	Cambridge	New Edition June 2022
3	Smart Cities for Sustainable Development	Ram Kumar Mishra, Ch Lakshmi Kumari, Sandeep Chachra, P.S. Janaki Krishna	Springer Switzerland	March 2022
4	Sustainable Development: Linking Economy, Society, Environment	Tracey Strange and Anne Bayley		
5	Management Of Resources For Sustainable Devpt	Sushma Goyal	The Orient Blackswan	2016
6	Energy, Environment and Sustainable Development: Issues and Policies	S. Ramaswamy Sathis G. Kumar	Regal Publications	2009
7	The New Map: Energy, Climate, and the Clash of Nations	Daniel Yergin	Penguin Press	September 2015
8	Contributions of Education for Sustainable Development (ESD) to	Laurie, R., Nonoyama-Tarumi, Y., Mckeown, R., & Hopkins, C.	A Synthesis of Research. Journal of Education for Sustainable	2016

	Quality Education:		Development, 10(2), 226–242.	
9	Sustainable Results in Development: Using the SDGs for Shared Results and Impact	OECD	OECD Publishing, Paris	2019
10	Development Discourse and Global History from colonialism to the sustainable development goals	Ziai, Aram	Routledge, London & New York	2016
11	Sustainable Development Goals An Indian Perspective,	Hazra, Somnath., Bhukta, Anindya	Springer Switzerland	2020
12	Environmental Ecology, Biodiversity and Climate Change	HM Saxena	Rawat Publication	January 2021

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: SDG-101
Course Title: Sustainable Development Goals (SDGs)

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Need and Importance of Sustainable Development	1	2	3	1	1	3	2	3	3	3	1	2	3	3	3	3
CO2 Education for Sustainable Development (ESD): Tools, Systems, and Innovation for Sustainability	1	3	2	1	3	3	2	1	2	1	1	1	3	3	3	3
CO3 Discuss the sustainable production and consumption	1	3	1	1	3	2	1	1	2	2	2	3	3	3	3	3
CO4 How	1	1	2	1	3	2	3	1	3	3	1	3	3	3	3	3

Climate Change may be Threat to Sustainable Development																
CO5 Role of Corporations and Ecological Sustainability	1	2	2	2	3	2	2	3	2	2	1	1	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Overview of basic definition of food science, food technology and evolution of food along with its nutritional values.	**SOs 1-5**	0	Basic definition regarding to food technology, Nutritional aspect of Food Global Production status of Food Industry and there location Nutritional Sciences and Neurochemistry in Food quality evaluation	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Explain the basic concept of different unit operations that involve for processing of raw material along with introduction of equipment.	**SOs 1-5**	0	History of food processing food processing method Major Unit operations Major Food Process Equipments used after harvesting	
PO 1 to 12 and PSO 1 to 4	CO3: Acquired the knowledge basic technical terms that is necessary for calculation of total heat and total calories in food.	**SOs 1-5**	0	Introduction to the basic technical terms Food Processing Introduction to Heat Introduction thermal properties of food Basic conversion used in energy calculations Horse Power, Electricity consumption mode of Heat Transfer Application of steam and heating element in food industry.	
PO 1 to 12 and PSO 1 to 4	CO4: Explain the concept of importance of food preservation along with its different types	**SOs 1-5**	0	Importance of food preservation along with its different types Importance of Food Preservation methods of Food Preservation Differences in Traditional and Modern method. Shelf Life of food material Assessment of spoilage level Deteriorative factors and their control	
PO 1 to 12 and PSO 1 to 4	CO5: Explain about overview of storage for storing of fruits, vegetable and grain along with its designing aspect and packaging of finished product	**SOs 1-5**	0	Food storage principles methods and structures of cereals, pulses, oilseed, fruits, vegetables, tea, coffee, cocoa bean, spices and other crop during storage. Major variables causes deterioration changes in crop during storage Technical aspect and importance of food packaging Role of Packaging in sales, marketing and distribution of food	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- I

Course Code:	54ME125
Course Title :	Workshop Technology
Pre- requisite:	Basic knowledge of mathematical skill with some scientific temperament.
Rationale:	It is a place of work for preparing variety of jobs/products by using different kinds of Instruments, hand tools and Machines. In order to prepare the products in workshop, the workshop is divided into many branches according to nature of work. Ex: 1.Fitting shop 2. Welding shop 3. Sheet metal shop 4. M/c Shop 5. Foundry & Forging shop etc

Course Outcomes (CO):

Course Code	Course Outcomes
54ME125.1	Acquire the knowledge about Introduction to basic materials and instruments used in mechanical workshop
54ME125.2	Acquired proficiency in using hand tools. Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.
54ME125.3	Practice on Carpentry work
54ME125.4	Operational skill development of Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;
54ME125.5	Learning about Estimation of machining time for different lathe operations

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54ME125	Workshop Technology	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54ME125	Workshop Technology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME125.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Introduction to basic materials: Ferrous and non-ferrous materials and important engineering materials such as timber, SO1.2 , abrasive materials, silica, ceramics, glasses, graphite, diamond, plastic polymers and composite materials, their properties and applications; Safety measures in workshop; Indian Factory Acts on safety; SO1.3 Measuring and Gauging: Basic measuring instruments and gauges; Heat treatment processes: Introduction to hardening, tempering, annealing, normalizing, etc.;	Identification of different materials of manufacture; Demonstration of different measuring instruments and measurement technique;	1.Introduction to basic materials: Ferrous and non-ferrous materials 2.Important engineering materials such as timber, abrasive materials, silica, ceramics, glasses, graphite, diamond, plastic polymers 3.Composite materials, their properties and applications; 4.Safety measures in workshop; 5. Indian Factory Acts on safety; 6.Measuring and Gauging: Basic measuring instruments and gauges; 7.Heat treatment processes: Introduction to hardening, tempering, annealing, normalizing, etc.;	Defects in timber

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME125.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Welding: Introduction, types of welding, types of electrodes, types of flames, types of welding joints, edge preparation, welding techniques and equipments; SO2.2 Gas welding and gas cutting, arc welding; Introduction to soldering and brazing and their uses; Estimation of welding and soldering cost; Smithying and forging: SO2.3 Introduction to different tools and their uses; Different forging operations, defects of forging; Brief ideas about power hacksaw, etc.;	Demonstration of various power tools and machine tools; Simple exercises in filing, fitting, chipping, hack sawing, chiseling, tapping, etc.; Introduction to welding machine, processes, tools, their use and precautions;	1.Welding: Introduction, types of welding, 2.Types of electrodes, types of flames, 3.Types of welding joints, edge preparation, 4.Welding techniques and equipments; 5.Gas welding and gas cutting, arc welding; 6.Introduction to soldering and brazing and their uses; 7.Estimation of welding and soldering cost; 8.Smithying and forging: Introduction to different tools and their uses; 9.Different forging operations, defects of forging; Brief ideas about power hacksaw, etc.;	To study the Different forging operations

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME125.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	4	4	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Carpentry: Introduction to various carpentry tools and materials; SO3.2 Type of woods and their characteristics, SO3.3 brief ideas about band saw, wooden lathe circular saw, wood planner, etc.;	Practical on carpentary work	1.Carpentry: Introduction to various carpentry tools and materials; 2.Type of woods and their characteristics, 3.Brief ideas about band saw, wooden lathe 4.Circular saw, wood planner, etc.;	To study the various types of wood used in engineering application

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME125.4

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Machinery: Introduction to various workshop machines Lathe, Milling machine, Shaper and planner, SO4.2 Drilling and boring machine, Grinder and CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;	Simple exercises on turning: Step turning, taper turning, drilling and threading; Introduction to shaper and planner machine and preparations of various jobs on them;	1.Machinery: Introduction to various workshop machines Lathe, Milling machine, 2.Shaper and planner, Drilling and boring machine, 3.Grinder and CNC machines; 4.Length of cut, feed, depth of cut 5.RPM, cutting speed, time, time allowances;	To study the working principle of Lathe Machine

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME125.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Estimation of machining time for different lathe operations; Estimation of machining time for casting, shaping, slotting and planning operations, work holding and tool holding devices; SO5.2 Sheet-metal: Introduction, different operations, sheet metal joints; Allowances for sheet metal, operations and joints, estimate of cost.	Introduction to drilling machines and preparation of a related jobs; Demonstration of other important operations and preparation of additional jobs.	1.Estimation of machining time for different lathe operations; 2.Estimation of machining time for casting, shaping, 3.Estimation of machining time for slotting and planning operations, 4.Estimation of machining time for work holding and tool holding devices; 5.Sheet-metal: Introduction, different operations, sheet metal joints; Allowances for sheet metal, operations and joints, estimate of cost.	To study the Estimation of machining time for different lathe operations

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54ME125.1: Acquire the knowledge about Introduction to basic materials and instruments used in mechanical workshop	7	4	1	1	13
54ME125.2: Acquired proficiency in using hand tools. Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	9	4	1	1	15
54ME125.3: Practice on Carpentry work	4	4	1	1	10
54ME125.4: Operational skill development of Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;	5	4	1	1	11
54ME125.5: Learning about Estimation of machining time for different lathe operations	5	4	1	1	11
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Acquire the knowledge about Introduction to basic materials and instruments used in mechanical workshop	04	05	01	10
CO-2	Acquired proficiency in using hand tools. Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	05	04	01	10
CO-3	Practice on Carpentry work	02	05	03	10
CO-4	Operational skill development of Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;	04	04	02	10
CO-5	Learning about Estimation of machining time for different lathe operations	05	03	02	10
Total		20	21	09	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Workshop Technology will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Elements of Workshop Technology	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.	Media promoters and publishers private limited, Mumbai	Vol. I 2008 and Vol. II 2010
2	Manufacturing Engineering and Technology	Kalpakjian S. And Steven S. Schmid	Pearson Education India	Edition, 2002
3	Manufacturing Technology	Rao P.N	Tata McGraw Hill House	Vol. I and Vol. II 2007
4	Processes and Materials of Manufacture	Roy A. Lindberg	Prentice Hall India,	4th edition, 1998

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54ME125
Course Title: Workshop Technology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Acquire the knowledge about Introduction to basic materials and instruments used in mechanical workshop	2	1	2	2	3	2	2	2	2	1	3	2	2	2	1	2
CO2 Acquired proficiency in using hand tools. Analyze and access the importance of welding	1	1	1	1	3	2	2	2	2	1	2	2	1	2	1	2

processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.																
CO3 Practice on Carpentry work	2	2	1	1	3	1	2	2	2	1	1	2	1	2	1	1
CO4 Operational skill development of Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;	2	2	2	1	3	2	2	2	2	1	2	2	1	2	1	2
CO5 Learning about Estimation of machining time for different lathe operations	2	1	1	1	1	3	2	2	2	1	2	2	1	2	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Acquire the knowledge about Introduction to basic materials and instruments used in mechanical workshop	**SOs 1-5**	4	Introduction to basic materials: Ferrous and non-ferrous materials and important engineering materials such as timber, abrasive materials, silica, ceramics, glasses, graphite, diamond, plastic polymers and composite materials, their properties and applications; Safety measures in workshop; Indian Factory Acts on safety; Measuring and Gauging: Basic measuring instruments and gauges; Heat treatment processes: Introduction to hardening, tempering, annealing, normalizing, etc.;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Acquired proficiency in using hand tools. Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.	**SOs 1-5**	4	Welding: Introduction, types of welding, types of electrodes, types of flames, types of welding joints, edge preparation, welding techniques and equipments; Gas welding and gas cutting, arc welding; Introduction to soldering and brazing and their uses; Estimation of welding and soldering cost; Smithying and forging: Introduction to different tools and their uses; Different forging operations, defects of forging; Brief ideas about power hacksaw, etc.;	
PO 1 to 12 and PSO 1 to 4	CO3: Practice on Carpentry work	**SOs 1-5**	4	Carpentry: Introduction to various carpentry tools and materials; Type of woods and their characteristics, brief ideas about band saw, wooden lathe circular saw, wood planner, etc.;	

PO 1 to 12 and PSO 1 to 4	CO4: Operational skill development of Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;	**SOs 1-5**	4	Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances;	
PO 1 to 12 and PSO 1 to 4	CO5: Learning about Estimation of machining time for different lathe operations	**SOs 1-5**	4	Estimation of machining time for different lathe operations; Estimation of machining time for casting, shaping, slotting and planning operations, work holding and tool holding devices; Sheet-metal: Introduction, different operations, sheet metal joints; Allowances for sheet metal, operations and joints, estimate of cost.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54FT221
Course Title :	Food Chemistry of Macronutrients
Pre- requisite:	Students should have basic knowledge of various metabolisms in Human body.
Rationale:	The students studying Food Chemistry of Macronutrients i.e. a scientific discipline that focuses to provide an introduction to macronutrients and micronutrients. To elucidate the roles and origins of carbohydrates, proteins and fats. To elucidate the roles and origins of various vitamins and minerals.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT221.1	Explain the Properties of Water and its impact at Food
54FT221.2	Explain the Dispersed system of Food.
54FT221.3	Acquired the knowledge for Carbohydrates processing.
54FT221.4	Acquired the knowledge for Lipids and Fat processing.
54FT221.5	Acquired the knowledge for Oil Refining and processing.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT221	Food Chemistry of Macronutrients	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT221	Food Chemistry of Macronutrients	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT221.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand Evolution and scope of Food Chemistry SO1.2 Understand Moisture in foods SO1.3 Understanding the Role and type of water SO1.4 Understanding the Water activity SO1.5 Understanding the Properties of Water.	1.Determination of moisture content of foods using different methods 2. Studies of sorption isotherms of different foods	1. Nature Scope and development of food chemistry 2. Moisture in foods 3. Role and type of water in foods 4.Functional properties of water 5. Water activity and sorption isotherm 6. Molecular mobility and foods stability	Knowledge about Structure of Water Knowledge about Moisture Content of all Food

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT221.2:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-2**	**Self Learning (SL)**
SO2.1 Understand Dispersed systems of foods SO2.2 Understand Sol and gel SO2.3 Understanding Foam SO2.4 Understanding Emulsion SO2.5 Understanding Rheology of diphase systems	1. Swelling and solubility characteristics of starches 2. Rheological properties of food systems	1. Dispersed systems of foods 2. Physicochemical aspects of food dispersion system (Sol) 3.Physicochemical aspects of food dispersion system (gel) 4.Physicochemical aspects of food dispersion system (foam) 5.Physicochemical aspects of food dispersion system (emulations) 6.Rheology of diphase systems	Knowledge about various forms of Solution Detailed requirement Formulation of Solution.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT221.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand fungi, algae and protozoa and virus SO3.2 Understand Nutrient transport phenomenon SO3.3 Understanding Microbial genetics SO3.4 Understanding Bacterial conjugation SO3.5 Understanding Bacterial transformation	1. Determination of crude proteins by micro-Kjeldhal method 2. Determination of essential amino acids	1. Carbohydrates: Changes of carbohydrates on cooking 2. Modification of carbohydrates, dietary fibres and carbohydrates digestibility 3. Enzymatic and chemical reactions of carbohydrates 4. Proteins in foods: Processing induced 5. Physical, chemical and nutritional changes in protein 6.Chemical and enzymatic modification of protein	Knowledge about various Structures of Carbohydrate Knowledge about Structures of Protein.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT221.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand Mutation and its types SO4.2 Understand Mutagenesis SO4.3 Understanding Designation of bacterial mutants SO4.4 Understanding Destruction of microorganisms SO4.5 Understanding Chemotherapeutic agents and chemotherapy.	1. Isolation of egg and milk protein 2. Preparation of protein isolate and concentrate of proteins	1. Lipids in foods 2. Role and use of lipids/fat, 3. Crystallization and consistency, chemical aspects of lipids, 4.Lipolysis, 5. Auto-oxidation, thermal decomposition 6. Chemistry of frying technology of fat and oil	Knowledge about various structures of lipids Detailed information on various structures of Fats.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT221.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Inoculation and Incubation SO5.2 Understand Methods of Pure Cultural Techniques SO5.3 Understanding types of Plating SO5.4 Understanding Preservation of Microbes SO5.5 Understanding Culture Cryopreservation	1. Determination of acid value 2. Saponification value and iodine number of fat/oil	1. Oil processing: Refining, hydrogenations 2. Inter esterification, 3. Safety use of oils and fats in food 4. formulation; Enzymatic and chemical reactions of fats 5. Rancidity and its types, detection techniques 6.Chemical aspects of lipids, antioxidants	Knowledge about Traditional Oil Refining Machine Knowledge about Advanced Oil Refining Machine.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT221.1: Explain the Properties of Water and its impact at Food	6	4	1	1	12
54FT221.2: Explain the Dispersed system of Food.	6	4	1	1	12
54FT221.3: Acquired the knowledge for Carbohydrates processing.	6	4	1	1	12
54FT221.4: Acquired the knowledge for Lipids and Fat processing.	6	4	1	1	12
54FT221.5: Acquired the knowledge for Oil Refining and processing.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Properties of Water and its impact at Food	03	02	01	06
CO-2	Dispersed system of Food.	03	05	03	11
CO-3	Carbohydrates processing.	03	05	03	11
CO-4	Lipids and Fat processing.	03	05	03	11
CO-5	Oil Refining and processing.	03	03	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Chemistry of Macronutrients will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Introductory Food Chemistry	John W. Brady	Cornell University Press, Ithaca, USA	2013
2	Food Chemistry	H.-D. Belitz, W. Grosch and P. Schieberle	Springer-Verlag Berlin Heidelberg	2009, 4th ED
3	Food Chemistry	Owen R, Fennema	Marcel Dekker, Inc., New York, USA	1996, 3rd Ed
4	Food Chemistry	Lillian Hoagland Meyer	The AVI Publishing Co Inc., Connecticut, MA, USA	1974

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT221
Course Title: Food Chemistry of Macronutrients

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO: Properties of Water and its impact at Food	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO:2 Dispersed system of Food	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO:3 Carbohydrates processing	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO:4 Lipids and Fat processing	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO:5 Oil Refining and processing	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Properties of Water and its impact at Food	**SOs 1-5**	4	Nature Scope and development of food chemistry; Moisture in foods, role and type of water in foods, functional properties of water, water activity and sorption isotherm, molecular mobility and foods stability	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Dispersed system of Food.	**SOs 1-5**	4	Dispersed systems of foods: Physicochemical aspects of food dispersion system (Sol, gel, foam, emulations); Rheology of diphase systems	
PO 1 to 12 and PSO 1 to 4	CO3: Carbohydrates processing.	**SOs 1-5**	4	Carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates; Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein	
PO 1 to 12 and PSO 1 to 4	CO4: Lipids and Fat processing.	**SOs 1-5**	4	Lipids in foods: Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil	
PO 1 to 12 and PSO 1 to 4	CO5: Oil Refining and processing.	**SOs 1-5**	4	Oil processing: Refining, hydrogenations, inter esterification, safety use of oils and fats in food formulation; Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques chemical aspects of lipids, antioxidants.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54FT222
Course Title :	Food Microbiology
Pre- requisite:	Students should have basic knowledge of various microbes and thei metabolism.
Rationale:	The students studying Food Microbiology i.e. is the study of th microorganisms that inhabit, create, or contaminate food. This includes th study of microorganisms causing food spoilage; pathogens that may caus disease (especially if food is improperly cooked or stored); microbes used t produce fermented foods such as cheese, yogurt, bread, beer, and wine; an microbes with other useful roles, such as producing probiotics.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT221.1	Recall the history of microorganisms in food and Explain the factors that affect microbial growth in food.
54FT221.2	Identify the microorganisms found in food.
54FT221.3	Compare various physical and chemical methods used in the control of microorganisms.
54FT221.4	Cultivate and enumerate microorganisms from various food samples.
54FT221.5	Illustrate the role of microorganisms in food safety.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT222	Food Microbiology	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT222	Food Microbiology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT222.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand Importance and significance of microbes SO1.2 Understand Microbial spoilage of foods SO1.3 Understanding the Intrinsic factors SO1.4 Understanding the Extrinsic factors SO1.5 Understanding the Chemical changes caused by microorganisms.	1. Isolation of bacteria and molds from foods 2. Microbial examination of cereal and cereal products`	1. Importance and significance of microbes in food science 2. Microbial spoilage of foods 3. Factors affecting kinds, numbers, growth and survival of microorganisms in foods 4. Intrinsic factors; pH,, water activity, nutrients etc. 5. Extrinsic factors: Relative humidity, temperature, gaseous atmosphere. 6. Chemical changes caused by microorganisms	Knowledge about various Changes in Food after spoilage in daily life

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT222.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand Changes in organic compounds SO2.2 Understand the methods of removal of microorganisms SO2.3 Understanding Sources of contamination SO2.4 Understanding Maintenance of anaerobic conditions SO2.5 Understanding Growth and Reproduction of bacteria.	1. Microbial examination of vegetable and fruits 2. Microbial examination of meat and meat products	1. Changes in nitrogenous organic compounds, non-nitrogenous organic compounds, organic acids, other compounds, lipids, pectic substances. 2. Contamination of foods and Sources of contamination 3. Genera of bacteria, Maintenance of anaerobic conditions; 4. Asepsis, removal of microorganisms 5. Intermediate moisture foods 6. Growth of bacteria Reproduction of bacteria	Knowledge about variable contaminations and spoilage conditions

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT222.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understanding Microbiology of Milk and milk Products SO3.2 Understanding Microbiology of fruits and vegetables SO3.3 Understanding Microbiology of cereal and cereal products SO3.4 Understanding Microbiology of meat, fish, sea foods, eggs and Poultry products SO3.5 Understanding Microbiology of Sugar, salt and spices	1. Microbial examination of fish and other sea foods: 2. Microbial examination of eggs and poultry	1. Microbiology of milk and milk products. 2. Microbiology of fruits and vegetables, 3 Microbiology of cereal and cereal products. 4. Microbiology of meat and meat products. 5. Microbiology of fish and other sea foods; Microbiology of poultry and eggs: 6. Microbiology of sugar and sugar products; Microbiology of salts and spices,	Knowledge about various Microbes and their Physical identification methods at Home.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT222.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand Microbiology of canned foods SO4.2 Understand Calculation of shelf life SO4.3 Understanding Deteriorative reactions SO4.4 Understanding Simulations of product SO4.5 Understanding Shelf life simulation.	1. Microbial examination of milk and milk products. 2. Microbial examination of sugar, salts and spices.	1. Microbiology of canned foods 2. Shelf life: Calculation of shelf life, Shelf life requirements, 3. Deteriorative reactions, accelerated testing; 4. Simulations of product: Package environment interaction. 5. Shelf life simulation for moisture 6. Oxygen, and light sensitive products	Knowledge about various types of shelf life in Packaged products

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT222.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO1.1 Understand Food borne intoxications SO1.2 Understand food involved, toxicity and symptoms SO1.3 Understanding Food borne viruses SO1.4 Understanding Types of food involved, toxicity and symptoms SO1.5 Understanding environmental conditions for toxicity	1. Determination and enumeration of pathogenic and indicator organisms in foods 2. Thermal death time determination	1. Food borne intoxications and infections types of food involved, toxicity and symptoms, chemical properties, environmental conditions. 2. Food borne viruses: Polio, hepatitis A & E, noroviruses, rota viruses, prion diseases. 3. Types of food involved, toxicity and symptoms, chemical properties, environmental conditions.	Knowledge about various methods to avoid food borne viruses

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT222.1: Recall the history of microorganisms in food and Explain the factors that affect microbial growth in food.	6	4	1	1	12
54FT222.2: Identify the microorganisms found in food.	6	4	1	1	12
54FT222.3: Compare various physical and chemical methods used in the control of microorganisms.	6	4	1	1	12
54FT222.4: Cultivate and enumerate microorganisms from various food samples.	6	4	1	1	12
54FT222.5: Illustrate the role of microorganisms	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Historical Overview of Food Microbes and Factors effecting Food.	03	02	01	06
CO-2	Spoilage and Contamination	03	05	03	11
CO-3	Microbiology of variable Foods	03	05	03	11
CO-4	Shelf Life of Food	03	05	03	11
CO-5	Food Borne Viruses	03	03	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Microbiology will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Microbiology	Martin R. Adams and Maurice O. Moss	Royal Society of Chemistry, Cambridge, UK	2008, 3rd Ed
2	Modern Food Microbiology	James M. Jay	Aspen Publishers, Inc., Gaithersburg, Maryland, USA	2000, 6th Ed
3	Textbook of Food Microbiology	Virendra Kumar Pandey	ISC Bangalore, Karnataka	2020, 1st Ed
4	Food Microbiology	William C. Frazier and & Dennis C. Westfoff	Tata McGraw-Hill Education, New Delhi.	1987, 4th Ed

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT222
Course Title: Food Microbiology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Historical Overview of Food Microbes and Factors effecting Food.	1	3	1	1	1	1	3	1	1	3	1	1	3	3	3	3
CO:2 Spoilage and Contamination	1	3	3	1	1	1	1	1	1	1	1	3	3	3	3	3
CO:3 Microbiology of variable Foods	1	3	1	1	1	1	3	1	1	1	1	3	3	3	3	3
CO:4 Shelf Life of Food	3	3	1	3	1	1	1	1	1	1	3	3	3	3	3	3
CO:5 Food	1	3	1	1	1	1	3	1	1	3	1	2	3	3	3	3

Borne Viruses															

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Historical Overview of Food Microbes and Factors effecting Food.	**SOs 1-5**	4	Importance and significance of microbes in food science; Microbial spoilage of foods Factors affecting kinds, numbers, growth and survival of microorganisms in foods; Intrinsic factors; pH,, water activity, nutrients etc., Extrinsic factors: Relative humidity, temperature, gaseous atmosphere; Chemical changes caused by microorganisms	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Spoilage and Contamination	**SOs 1-5**	4	Changes in nitrogenous organic compounds, non-nitrogenous organic compounds, organic acids, other compounds, lipids, pectic substances; Contamination of foods; Sources of contamination, Genera of bacteria, Maintenance of anaerobic conditions; Asepsis, removal of microorganisms; Intermediate moisture foods	
PO 1 to 12 and PSO 1 to 4	CO3: Microbiology of variable Foods	**SOs 1-5**	4	Microbiology of milk and milk products; Microbiology of fruits and vegetables, Microbiology of cereal and cereal products, Microbiology of meat and meat products, Microbiology of fish and other sea foods; Microbiology of poultry and eggs: Microbiology of sugar and sugar products; Microbiology of salts and spices,	
PO 1 to 12 and PSO 1 to 4	CO4: Shelf Life of Food	**SOs 1-5**	4	Microbiology of canned foods, Shelf life: Calculation of shelf life, Shelf life requirements, deteriorative reactions, accelerated testing; Simulations of product: Package environment interaction, shelf life simulation for moisture, oxygen, and light sensitive products	
PO 1 to 12 and PSO 1 to 4	CO5: Food Borne Viruses	**SOs 1-5**	4	Food borne intoxications and infections types of food involved, toxicity and symptoms, chemical properties, environmental conditions. Food borne viruses: Polio, hepatitis A & E, noroviruses, rota viruses, prion diseases. Types of food involved, toxicity and symptoms, chemical properties, environmental conditions.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54EE226
Course Title :	Basic Electronics Engineering
Pre- requisite:	Student should have basic knowledge of mathematics, physics, and Semiconductor material.
Rationale:	This course aims to introduce the basic concepts, Working Principles and Applications of analog and digital electronics with the basics of general instrumentation and measurement techniques

Course Outcomes (CO):

Course Code	Course Outcomes
54EE226.1	Explain the concept of semiconductor material, diode and its applications.
54EE226.2	Understanding the concept of Different electronic components and their working principles.
54EE226.3	Explain the principle, construction and working of Electronics circuits such as differential amplifier and operational amplifier.
54EE226.4	Introduction of Voltage regulators its type, Boolean algebra and A/D, D/A converters.
54EE226.5	Introducing the concept of Generalized Instrumentation and different measuring instruments.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54EE 226	Basic Electronics Engineering	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54EE 226	Basic Electronics Engineering	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE226.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the semiconductor material and its properties SO1.2 To study of diode and its application SO1.3 Understand the applications of diode as circuit elements. SO1.4 Understand diode circuits.	1. Study of diode characteristic 2. Study of V-I characteristics of P-n junction diode	1.1 Semiconductors, P-n junction, V-I characteristics of P-n junction 1.2 diode as a circuit element, rectifier and its types 1.3 clipper and types, clamper and types, 1.4 voltage multiplier, filter circuits; 1.5 Diode circuits for OR and AND (both positive and negative logic)	1. Knowledge about insulator conductor and semiconductor

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE226.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the BJT SO2. Understand the operating point and working of BJT SO2.3 Understand the modes of operation of BJT SO2.4 Understand amplifier and its types SO2.5 Understand the analysis of small signal, CE amplifier, phase shift oscillator,	1. Study of RC coupled amplifier; 2. Study of RC phase shift oscillator;	2.1 Bipolar junction transistor and types 2.2 working and construction of BJT 2.3 Operating point, classification (A, B and C) of amplifier, 2.4 various biasing methods (fixed, self, potential divider); 2.5 Coupling of amplifiers, h-parameter model of a transistor, 2.6 analysis of small signal, CE amplifier, 2.7phase shift oscillator,	1. Basic Knowledge of diode

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE226.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the amplifier and its applications SO3.2 Understand the basics of OP-AMP and its characteristics SO3.3 Understand the different applications of OP-AMP SO3.4 Understand the instrumentation amplifier and oscillator	1. Study of OP-Amp IC 741 as differential amplifier; 2. Study of half wave rectifier	3.1 Analysis of differential amplifier using transistor, 3.2 ideal OP-AMP and its characteristics, 3.3 linear and non-linear applications of OP-AMP 3.4 OP-AMP as integrator, active rectifier, 3.5 comparator, differentiator, differential, 3.6 instrumentation amplifier and oscillator,	1. Knowledge about basic mathematical functions like differentiation integration

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE226.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the basics of Zener diode SO4.2 Understand the concepts of voltage regulator SO4.3 Understand the different types of voltage regulator. SO4.4 Understand the basics of Boolean algebra and logic gates SO4.5 Understand the concepts of logic circuits and A/D converters	1. Study of Zener diode 2. Study of OP-AMP IC 741 as a active rectifier	4.1 Zener diode as voltage regulator, 4.2 transistor series regulator, 4.3 transistor series regulator current limiting, 4.4 OP-AMP voltage regulators; 4.5 Basic theorem of Boolean algebra; Combinational logic circuits 4.6 basic gates, SOP rule and K-map, binary ladder D/A converters	1. basics of Zener diode and logic gates

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54EE226.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Discuss about the advantages of Instrumentation and measurement SO5.2 Understand the Building blocks and Operations of different instruments SO5.3 Understand the Building blocks and Operations of measurement techniques. SO5.4 Study of different types of instruments	1. Study of temperature characteristics of resistor 2. Verification of logic gates	5.1 Measurement of displacement, temperature, 5.2 measurement of velocity, force 5.3 generalized instrumentation, measurement of displacement, temperature, velocity, force and 5.4 pressure using potentiometer, 5.5 resistance thermometer, 5.6 thermocouples.	1. Basics of displacement temperature velocity and potentiometer.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54EE226.1: Explain the concept of semiconductor material, diode and its applications	5	4	1	1	11
54EE226.2: Understanding the concept of Different electronic components and their working principles.	7	4	1	1	13
54EE226.3: Explain the principle, construction and working of Electronics circuits such as differential amplifier and operational amplifier,	6	4	1	1	12
54EE226.4: Introduction of Voltage regulators its type, Boolean algebra and A/D, D/A converters.	6	4	1	1	12
54EE226.5: Introducing the concept of Generalized Instrumentation and different measuring instruments.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Semiconductor diode and its application	03	03	01	07
CO-2	Transistor and its application	03	05	02	10
CO-3	Operational Amplifier and its Application	03	06	03	12
CO-4	Voltage Regulators and Logic Circuits	03	03	04	10
CO-5	Generalized Instrumentation	03	03	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Basic Electronics Engineering will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Applied Electronics and Instrumentation	H.S.Kalsi.	Tata McGraw Hill.	Fourth, 2019
2	Electrical Measurement and Measuring	E.W. Golding,	Sir Isaac Pitman and Sons, Ltd. London	1940
3	Electrical and Electronic measurements and Instrumentation,	A.K. Sawhney,	Dhanpat Rai and Co..	2012
4	Electronic Measurements and Instrumentation	K. Lala Kishore	Pearson Education	Kindle Edition, 2009

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54EE226
Course Title: Basic Electronics Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Explain the concept of semiconductor material, diode and its applications	3	2	3	1	1	3	2	3	3	3	1	2	3	3	3	3
CO2 Understanding the concept of Different electronic components and their working principles	3	2	2	1	3	3	2	1	2	1	1	1	3	3	3	3
CO3 Explain	3	3	1	1	3	2	1	1	2	2	3	3	3	3	3	3

the principle, construction and working of Electronics circuits such as differential amplifier and operational amplifier																
CO4 Introduction of Voltage regulators its type, Boolean algebra and A/D, D/A converters.	3	1	3	1	3	2	3	1	3	3	1	3	3	3	3	3
CO5 Introducing the concept of Generalized Instrumentation and different measuring instruments.	3	2	2	1	3	2	2	3	2	2	1	1	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Explain the concept of semiconductor material, diode and its applications	**SOs 1-5**	4	Semiconductors, P-n junction, V-I characteristics of P-n junction, diode as a circuit element, rectifier, clipper, clamper, voltage multiplier, filter circuits; Diode circuits for OR and AND (both positive and negative logic)	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Understanding the concept of Different electronic components and their working principles.	**SOs 1-5**	4	Bipolar junction transistor: Operating point, classification (A, B and C) of amplifier, various biasing methods (fixed, self, potential divider); Coupling of amplifiers, h-parameter model of a transistor, analysis of small signal, CE amplifier, phase shift oscillator,	
PO 1 to 12 and PSO 1 to 4	CO3: Explain the principle, construction and working of Electronics circuits such as differential amplifier and operational amplifier	**SOs 1-5**	4	Analysis of differential amplifier using transistor, ideal OP-AMP characteristics, linear and non-linear applications of OP-AMP integrator, active rectifier, comparator, differentiator, differential, instrumentation amplifier and oscillator),	
PO 1 to 12 and PSO 1 to 4	CO4: Introduction of Voltage regulators its type, Boolean algebra and A/D, D/A converters.	**SOs 1-5**	4	Zener diode voltage regulator, transistor series regulator, current limiting, OP-AMP voltage regulators; Basic theorem of Boolean algebra; Combinational logic circuits (basic gates, SOP rule and K-map, binary ladder D/A	
PO 1 to 12 and PSO 1 to 4	CO5: Introducing the concept of Generalized Instrumentation and different measuring instruments.	**SOs 1-5**	4	Converter of displacement, temperature, velocity, force and generalized instrumentation, measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54CA224
Course Title :	Computer Programming and Data Structures
Pre- requisite:	Student should have a basic understanding of Fundamental of Computer. Student should aware of how to power on computer and how to shut down computer.
Rationale:	Importance of C programming and its practical applications C programming language holds immense importance in the software development industry. Its simplicity, efficiency, and versatility make it a powerful tool for developing a wide range of applications. From operating systems to embedded systems, C finds its use in numerous domains. data structure and algorithm design methods impacts the performance of programs

Course Outcomes (CO):

Course Code	Course Outcomes
54CA224.1	Able to describe basic components like Memory input output devices, micro processor hardware and software.
54CA224.2	Able to describe Algorithms and flow-charts. Student will explain the core concept of C Ability to write programs that solve problems and perform various operations using the C programming language.
54CA224.3	At the end of this chapter the student will use Array and Function in programs. Proficiency in using decision-making structures (if, else, switch) and loops (for, while, do-while) for program control.
54CA224.4	Able to describe the syntax rules, data types, variables, and operators in the C language.
54CA224.5	Able to describe Standard library functions, managing input and output, decision making fundamental concepts including arrays, linked lists, stacks, queues,

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54CA 224	Computer Programmin gand Data Structures	1	4	1	1	7	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Cour se Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+E SE)
			SA 1	SA2			
PCFT	54C A 224	Computer Programmin gand Data Structures	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54CA224.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understanding introduction, history and component of Computer. SO1.2 Understanding memory, hardware and software	1.To print the simple message 2.Developing and executing simple programs	1.1 Understand the introduction, history and components of computer 1.2 Describe the memory and its types 1.3 Describe the software and its types	Brief review of present-day applications

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54CA224.2:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-2**	**Self Learning (SL)**
SO2.1 Understanding C language, data types, library function and operators SO2.2 Understanding algorithm, flow chart and structure of c program	1. Demonstrating IDE of C and role of compiler 2. C program to add two numbers	2.1 Describe the Algorithms and flow- charts 2.2 Understand the introduction and structure of c program 2.3 Describe the data types and operators	Library function in C language

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54CA224.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	4	4	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understanding control structure with examples SO3.2 Understanding structure and union with examples SO3.3 Understanding string function with Examples SO3.4 Understanding array and its types	1. To check whether a number is positive, negative or zero 2. To print Fibonacci series	3.1 Describe the Conditional , goto and iterative statements 3.2 Describe the array and its types 3.3 Describe the structure and union 3.4 Describe the character and string function	What is function? Passing argument by value, by reference in function

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54CA224.4

Items	CI	LI	SW	SL	Total
Approx. Hours	2	4	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding header file and input output files SO4.2 Understanding variable, data types and operators SO4.3 Understanding high level language	1. To converting into double data type 2. Write program to using logical and arithmetic operators	4.1 Describe the Concept of standard input and output files, header files, Formatting of data on input and output 4.2 Describe the variable, data type and type casting like implicit and explicit	Introduction to high level language

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54CA224.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understanding function, scope and visibility of a variable SO5.2 Understanding data structure stack, queues and linked list	1. Function to calculate the factorial of a number 2. To insert and delete elements in a stack	5.1 Describe the function, user define, input and output function, recursion, Pointers 5.2 Describe the stacks, push/pop operations, queues, insertion and deletion operations 5.3 Describe the linked list and its types.	Scope and visibility of a variable

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54CA224.1: Able to describe basic components like Memory input output devices, micro processor hardware and software.	3	4	1	1	9
54CA224.2: Able to describe Algorithms and flow-charts. Student will explain the core concept of C Ability to write programs that solve problems and perform various operations using the C programming language.	3	4	1	1	9
54CA224.3: At the end of this chapter the student will use Array and Function in programs. Proficiency in using decision-making structures (if, else, switch) and loops (for, while, do-while) for program control.	4	4	1	1	10
54CA224.4: Able to describe the syntax rules, data types, variables, and operators in the C language.	2	4	1	1	8
54CA224.5: Able to describe Standard library functions, managing input and output, decision making fundamental concepts including arrays, linked lists, stacks, queues,	3	4	1	1	9
Total Hours	15	20	5	5	45

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Able to describe basic components like Memory input output devices, micro processor hardware and software.	05	05	00	10
CO-2	Able to describe Algorithms and flow-charts. Student will explain the core concept of C Ability to write programs that solve problems and perform various operations using the C programming language.	01	02	07	10
CO-3	At the end of this chapter the student will use Array and Function in programs. Proficiency in using decision-making structures (if, else, switch) and loops (for, while, do-while) for program control.	01	02	07	10
CO-4	Able to describe the syntax rules, data types, variables, and operators in the C language.	03	05	02	10
CO-5	Able to describe Standard library functions, managing input and output, decision making fundamental concepts including arrays, linked lists, stacks, queues,	03	04	03	10
Total		13	18	19	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Computer Programming & Data Structure will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Fundamentals of Computer Programming with c	Svetlin Nakov &Co		2013
2	Programming inC	E. Balagurusamy	Tata McGraw-Hill Publishing Company Limited, New	2008
3	Let Us C	Yashavant Kanetkar	Seventh Edition, BPB Publications	2007

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54CA224
Course Title: Food Thermodynamics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Able to describe basic components like Memory input output devices, micro processor hardware and software.	2	2	2	1	3	1	1	-	1	3	2	3	3	2	3	2
CO2 Able to describe Algorithms and flow-charts. Student will explain the core concept of C Ability to write	3	1	2	2	3	2	2	-	1	2	3	3	3	2	2	2

programs that solve problems and perform various operations using the C programming language.																
CO3 At the end of this chapter the student will use Array and Function in programs. Proficiency in using decision-making structures (if, else, switch) and loops (for, while, do-while) for program control.	2	2	2	2	3	2	2	-	1	2	3	3	3	2	2	2
CO4 Able to describe the syntax rules, data types, variables, and operators in the C language.	2	2	2	2	3	2	2	-	1	2	3	3	3	2	2	2
CO5 Able to describe Standard library functions, managing input and output, decision making fundamental concepts including arrays, linked lists, stacks, queues,	2	2	2	2	3	2	2	-	1	2	3	3	3	2	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Able to describe basic components like Memory input output devices, micro processor hardware and software.	**SOs 1-5**	4	Introduction and historical background: Review of computer technology; Processor, memory, secondary storage, display devices and other peripheral devices; Basic computer organization, future trends; Brief review of present-day applications, programming; Introduction to systems software, applications software and programming language;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Able to describe Algorithms and flow-charts. Student will explain the core concept of C Ability to write programs that solve problems and perform various operations using the C programming language.	**SOs 1-5**	4	Algorithms and flow-charts: Input-processing-output model of a computer program; Role of the compiler and the integrated development environment; Introduction to C: Structure of a C program, simple data types, declarations, operators and expressions; The assignment statement; Library functions;	
PO 1 to 12 and PSO 1 to 4	CO3: At the end of this chapter the student will use Array and Function in programs. Proficiency in using decision-making structures (if, else, switch) and loops (for, while, do-while) for program control.	**SOs 1-5**	4	Control Structures: Conditional and iterative execution of statements; Importance of documentation; Nesting of control structures and the use of indentation to indicate nesting levels; Labels and the "go to" statement; Arrays; Single and multi-dimensional arrays: Character strings and string functions; Functions: Scope rules; Argument passing by reference and by value; Storage classes; Use of function prototypes; Structures, unions and user-defined types;	
PO 1 to 12 and PSO 1 to 4	CO4: Able to describe the syntax rules, data types, variables, and operators in the C language.	**SOs 1-5**	4	Operations on files: Concept of standard input and output files; Formatting of data on input and output; Use of include files; Introduction to high level languages; Primary data types and user defined data types, variables, typecasting, operators, building and evaluating expressions,	

PO 1 to 12 and PSO 1 to 4	CO5: Able to describe Standard library functions, managing input and output, decision making fundamental concepts including arrays, linked lists, stacks, queues,	**SOs 1-5**	4	Standard library functions, managing input and output, decision making, branching, looping, arrays, user defined functions, passing arguments and returning values, recursion, scope and visibility of a variable, string functions, structures and union, pointers, stacks, push/pop operations, queues, insertion and deletion operations, linked lists.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54MS227
Course Title :	Engineering Mathematics –I
Pre- requisite:	Students remember terminologies and formulae matrix the fundamentals of calculus.
Rationale:	The program aims to develop advanced problem-solving and analytical skills and prepares students for careers in academia, research, industry, or other sectors that require advanced mathematical expertise.

Course Outcomes (CO):

Course Code	Course Outcomes
54MS227.1	Define and understand the concept of matrix, formulation, types of matrix and operation of matrix .Differentiate between different types of matrices
54MS227.2	Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics. Cayley Hamilton theorem, solution of linear equation.
54MS227.3	Define and compute partial derivatives of functions of several variables, Define taylor and maclurine curvature homogenous function and eulers theorem, Apply the chain rule to compute derivatives of composite functions involving multiple variables,
54MS227.4	Apply integration techniques, including substitution, integration by parts, and partial fractions. Application of double and triple integral and volume and surface of revolution.
54MS227.5	Understand the scalar and vector point function, gradient and their physical interpretation Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54MS227	Engineering Mathematics -I	2	0	1	2	5	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54MS 227	Engineering Mathematics -I	20	20	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS227.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the concept of matrix and types. SO1.2 Understand the operation of matrix , adjoint ,triangular matrix, SO1.3 Apply rank of matrix So1.4 Understand the hypothesis of L' Hospital's rule So1.5 Understand the concept of curvature.	-	1.1.elementray matrix, elementary transformation 1.2. rank of matrix, reduction to normal form 1.3.G-J method, Tutorial-1 1.4. to find the inverse, eigen values 1.5 eigenvectors, normal form 1.6 problem based on rank, Tutorial- 2	1 Define the matrix with types and operations.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS227.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Define and understand the basic concepts of matrices, determinant, etc SO2.2 Perform basic matrix operations, including addition, subtraction, and scalar multiplication SO2.3 Understand the connection between matrix equations and systems of linear equations SO2.4 Define and compute the determinant of a matrix SO2.5 Understand rank method to solve matrix	-	2.1.linear transformation, orthogonal 2.2.diagonolization, quadratic form 2.3.system of linear equations, nature of rank 2.4.echelon form, cases on solution of system of linear equation 2.5.to find inverse by Cayley-Hamilton Theorem, linear systems of equations and homogenous and non homogenous 2.6 rank on coefficient and augmented matrix, Tutorial-1	1 Explore more advanced topics, such as linear transformations, matrix norms, and applications

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS227.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Define and compute partial derivatives of functions of several variables SO3.2 Understand the partial derivative and its relation SO3.3 compute homogenous function of composite functions involving multiple variables SO3.4 Understand to find maxima and minima in a single variable SO3.5 Identify critical points of multivariable functions	-	Unit-3.0 3.1. Taylor expansion, total derivative, 3.2. Euler's theorem on Homogeneous function, Application of Euler's theorem deduction I 3.3. Application of Euler's theorem deduction II, curvature 3.4. maxima, minima, saddle points, 3.5. working method on exttemum, partial derivatives 3.6 Questions of partial differvatives, Tutorial-1	1 Apply Eulers theorem to solve homogenous function problems

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS227.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the definition of surface of revolution SO4.2 Understand the indefinite and definite integral with single variable SO4.3 Identify and use integral with application to find area. SO4.4 Identify area and volume in continuous variable SO4.5 Recognize and solve area by integration	-	4.1.volumeof revolution, surface of revolution of curves 4.2.double integrals, triple integrals 4.3 Tutorial-1, change of order of integration 4.4. application of double integral, application of triple integral 4.5.find area in double integral, find volume in triple integral 4.6 area and volume as limit is constant, Tutorial-2	1 Analyze volume and surface of revolution

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS227.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO4.1 Understand the basic concept of scalar and vector with their properties. SO4.2 Find calculus in vector point function with partial differentiation. SO4.3 Understand the concept of a solenoidal and irrotational vector. SO4.4 Interpret definite integrals vector point function. SO4.5 Understand and apply the double and triple integral.	-	Unit-5.0 5.1.differentiation ofvectors, scalar point function, vector differential operator 5.2. gradient of a scalar point function, divergence and curl of a vector point function 5.3. their physical interepretation, identities involving del 5.4. second order differential operator, line surface and volume integrals 5.5. stokes theorem , divergence theorem 5.6 greens theorem, Tutorial-1	1 Apply differentation techniques invectors

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54MS227.1: Define and understand the concept of limits, Evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions.	6	0	1	1	8
54MS227.2: Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.	6	0	1	1	8
54MS227.3: Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.	6	0	1	1	8
54MS227.4: Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables	6	0	1	1	8

technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena.					
54MS227.5: Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.	6	0	1	1	8
Total Hours	30	00	5	5	40

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Matrices-I	02	04	05	11
CO-2	Matrices-II	03	07	04	14
CO-3	Differential Calculus	02	06	02	10
CO-4	Integral Calculus	03	03	02	08
CO-5	Vector calculus	03	02	02	07
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Engineering Mathematics –I will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mathematics-I ,	D.K, Jain	Shree Ram Prakashan.	7th Edition 2015-16
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers Shree Sai Prakashan	36th Edition, 2010 10th Edition 2018
3	Engineering Mathematics-I	D.C.Agrawal	Tata McGraw Hill	11th Reprint, 2010.
4	Higher Engineering Mathematics	B.V.Ramana		

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54MS227
Course Title: Engineering Mathematics –I

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Define and understand the concept of limits, Evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear		3		3												

approximation and differentials to estimate values of functions.																
CO2 Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.		3		3												
CO3 Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable		3		3												

functions.																
CO4 Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena.		3		3												
CO5 Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.		3		3												

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Define and understand the concept of limits, Evaluate limits algebraically and graphically, Apply the basic rules of differentiation, including the power rule, product rule, quotient rule, and chain rule. Use linear approximation and differentials to estimate values of functions.	**SOs 1-5**	4	Differential calculus: Taylor's and Maclaurin's expansions, indeterminate form; Curvature, asymptotes, tracing of curves, function of two or more independent variables, partial differentiation, homogeneous functions and Euler's theorem, composite functions, total derivatives, derivative of an implicit function, change of variables, Jacobians, error evaluation, maxima and minima;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Define and understand the basic concepts of matrices, Differentiate between different types of matrices Perform basic matrix operations, Use matrices to represent and solve systems of linear equations. Explore more advanced topics, such as linear transformations, matrix norms, and applications in optimization and computer graphics.	**SOs 1-5**	4	Integral calculus: Reduction formulae, rectification of standard curves, volumes and surfaces of revolution of curves, double and triple integrals, change of order of integration, gamma and beta functions, application of double and triple integrals to find area and volume;	

PO 1 to 12 and PSO 1 to 4	CO3: Define and compute partial derivatives of functions of several variables, Define and compute the gradient vector of a scalar function, Apply the chain rule to compute derivatives of composite functions involving multiple variables, Identify critical points of multivariable functions.	**SOs 1-5**	4	Ordinary differential equations: Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's equation, differential equations of higher orders, methods of finding complementary functions and particular integrals, method of variation of parameters,	
PO 1 to 12 and PSO 1 to 4	CO4: Understand the definition of a first-order ordinary differential equation, Solve separable differential equations using the separation of variables technique, Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena.	**SOs 1-5**	4	Cauchy's and Legendre's linear equations, simultaneous linear differential equations with constant coefficients, series solution techniques, Bessel's and Legendre's differential equations;	
PO 1 to 12 and PSO 1 to 4	CO5: Understand and state the Fundamental Theorem of Calculus, both parts and apply the Fundamental Theorem to	**SOs 1-5**	4	Vector calculus: Differentiation of vectors, scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of a vector point function and their physical interpretations, identities involving Del, second order differential operator; Line, surface and volume integrals, Stoke's, divergence and Green's theorems.	

	evaluate definite integrals. Apply integration techniques, including substitution, integration by parts, and partial fractions.				

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54ME225
Course Title :	Fluid Mechanics
Pre- requisite:	Students are expected to know the fundamentals of engineering mechanics, resolving of forces, Statics, Dynamics and flow kinematics.
Rationale:	Fluid mechanics and hydraulics is core to engineering, offering vital insights into liquid and gas behavior for efficient system design across industries like power generation, aerospace, and infrastructure. Understanding fluid dynamics drives innovation, impacting energy, transportation, and environmental sectors globally, with applications reaching into fields like medicine and meteorology.

Course Outcomes (CO):

Course Code	Course Outcomes
54ME225.1	Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).
54ME225.2	Analyze the Fluid flow and Classification,
54ME225.3	Learning about Flow through orifices, mouthpieces, notches and weirs;
54ME225.4	Acquire the knowledge about Dimensional analysis
54ME225.5	Acquire the knowledge about Turbines and pumps

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54ME 225	Fluid Mechanics	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54ME 225	Fluid Mechanics	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME225.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Units and dimensions; Properties of fluids; Static pressure of liquids: Hydraulic pressure, absolute and gauge pressure, SO1.2 Pressure head of a liquid; Pressure on vertical rectangular surfaces; SO1.3 Flow behavior of viscous foods; Compressible and non-compressible fluids; Surface tension, capillarity; SO1.4 Pressure measuring devices: Simple, differential, micro-, inclined manometer, mechanical gauges, piezometer; SO1.5 Floating bodies: Archimedis principle, stability of floating bodies; Equilibrium of floating bodies, metacentric height	1. Determination of Metacentric Height of Flat bottomed pantoon. 2. Study of Pressure Gauge	1.Units and dimensions; 2.Properties of fluids; Static pressure of liquids: Hydraulic pressure, absolute and gauge pressure, pressure head of a liquid; Pressure on vertical rectangular surfaces; 3.Flow behavior of viscous foods; Compressible and non-compressible fluids; Surface tension, 4.Capillarity; Pressure measuring devices: Simple, differential, micro-, inclined manometer, 5.Mechanical gauges, piezometer; 6.Floating bodies: Archimedis principle, stability of floating bodies; 7.Equilibrium of floating bodies, metacentric height;	1. To study the different properties of fluid

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME225.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Fluid flow: Classification, steady, uniform and non-uniform, laminar and turbulent, continuity equation; Bernoulli's theorem and its applications; SO2.2 Navier-Stokes equations in cylindrical co-ordinates, boundary conditions; Simple application of Navier-Stokes equation: SO2.3 Laminar flow between two straight parallel boundaries; Flow past through the immersed solids, packed and fluidized beds; SO2.4 Flow through pipes: Loss of head, determination of pipe diameter; Determination of discharge, friction factor, critical velocity;	1. To study the Bernoulli's theorem 2. To determine the minor head loss coefficient of different pipe fittings.	1. Fluid flow: Classification, steady, uniform and non-uniform, laminar and turbulent, continuity equation; 2.Bernoulli's theorem and its applications; 3.Navier-Stokes equations in cylindrical co-ordinates, boundary conditions; 4.Simple application of Navier-Stokes equation: Laminar flow between two straight parallel boundaries; 5.Flow past through the immersed solids, packed and fluidized beds; Flow through pipes: Loss of head, determination of pipe diameter; 6.Determination of discharge, friction factor, critical velocity;	1. To study the application of Bernoulli's theorem

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME225.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3:1 Flow through orifices, mouthpieces, notches and weirs; SO3:2 Vena contracta, hydraulic coefficients, discharge SO3:3 losses; Time for emptying a tank; Loss of head due to contraction, enlargement at entrance and exit of pipe; SO3:4. External and internal mouthpieces, types of notches, rectangular and triangular notches, rectangular weirs; Venturimeters, pitot tube, rotameter; Water level point gauge, hook gauge;	3.1 Determine the Renyold's no in different flow conditions. 3.2 Determination of Coefficient of Discharge of Rectangular and Triangular Notch.	1.Flow through orifices, mouthpieces, notches and weirs; 2.Vena contracta, hydraulic coefficients, discharge losses; 3.Time for emptying a tank; Loss of head due to contraction, enlargement at entrance and exit of pipe; 4.External and internal mouthpieces, types of notches, rectangular and triangular notches, rectangular weirs; 5.Venturimeters, pitot tube, rotameter; 6.Water level point gauge, hook gauge;	1. To study the function of Orifice

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME225.4

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Grasp Euler's and Bernoulli's equations and their practical applications in fluid dynamics. SO4.2 Explore Venturimeter, Orifice meter, Nozzle, and Pitot tube functionalities in measuring fluid flow. SO4.3 Apply impulse momentum and momentum of momentum equations for fluid behavior analysis. SO4.4 Understand kinetic energy and momentum correction factors in fluid systems' energy analysis. SO4.5 Apply Reynold's transport theorem to understand property transport in flowing fluids.	4.1 Verification of Bernoulli's Theorem experimentally. 4.2 Determination of coefficient of Discharge of venturimeter.	1.Dimensional analysis: 2.Buckingham's theorem application to fluid flow phenomena, 3.Froude Number, 4.Reynolds number, 5.Weber number and hydraulic similitude;	1. Choose a real life example and demonstrate how Bernoulli's Equation can be applied to analyze the fluid mechanics.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME225.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Turbines and pumps: classification, centrifugal pumps, submersible pumps, reciprocating pumps, positive displacement pump; Centrifugal pumps: Pumps in series and parallel, basic equations applied to centrifugal pump, SO5.2 loss of head due to changed discharge, static head, total head, manometric head, manometer efficiency, operating characteristics of centrifugal pumps, Submersible pumps; Reciprocating pumps SO5.3 Working of reciprocating pump, double acting pump, instantaneous rate of discharge, acceleration of piston and water, gear pump; Pressure variation, SO5.4 work efficiency; Pressure requirements for viscous foods to lift them to different heights and selection of pumps; Open channel hydraulics: Classification of open channel and definitions, SO5.5 most economical sections of regular cross-sections; Specific energy concept-critical depth, energy diagrams; Velocity and pressure profiles in open channels; Hydraulic jumps-types.	5.1 Determination of Friction Factor 'f' for G.I pipes. 5.2 Study of Boundary Layer theory	1.Classification, centrifugal pumps, submersible pumps, reciprocating pumps, positive displacement pump; 2.Pumps in series and parallel, basic equations applied to centrifugal pump, loss of head due to changed discharge, static head, total head, manometric head, manometer efficiency, operating characteristics of centrifugal pumps, Submersible pumps 3.Working of reciprocating pump, double acting pump, instantaneous rate of discharge, acceleration of piston and water, gear pump; Pressure variation, work efficiency; 4.Pressure requirements for viscous foods to lift them to different heights and selection of pumps 5.Classification of open channel and definitions, most economical sections of regular cross-sections; Specific energy concept-critical depth, energy diagrams; 6.Velocity and pressure profiles in open channels; Hydraulic jumps-types.	1To study the classification of different pumps

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54ME225.1: Explain the concept of semiconductor material, diode and its applications	7	4	1	1	13
54ME225.2: Understanding the concept of Different electronic components and their working principles.	6	4	1	1	12
54ME225.3: Explain the principle, construction and working of Electronics circuits such as differential amplifier and operational amplifier,	6	4	1	1	12
54ME225.4: Introduction of Voltage regulators its type, Boolean algebra and A/D, D/A converters.	5	4	1	1	11
54ME225.5: Introducing the concept of Generalized Instrumentation and different measuring instruments.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Properties of Fluid and Fluid Statics	03	01	01	05
CO-2	Fluid Kinematics	02	06	02	10
CO-3	Fluid Dynamics	02	07	06	15
CO-4	Laminar and Turbulent Flow and Flow through Pipes	02	07	06	15
CO-5	Internal Flows and Dimensional Analysis	01	02	02	05
Total		10	23	17	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Fluid Mechanics will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	A Textbook of Fluid Mechanics and Hydraulic Machines	R. K. Bansal	Laxmi Publication	2005
2	Fluid Mechanics & Hydraulic Machines	S.S. Rattan	Khanna Book Publishing	2019
3	Introduction to Fluid Mechanics,	P.J. Pritchard, A.T. McDonald and R.W. Fox	Wiley India	2012
4	"Fluid Mechanics	F.M. White	Tata McGraw Hill	2011

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54ME225
Course Title: Fluid Mechanics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	3	2	3	1	1	1	1	-	3	2	1	3	2	2	2	2
CO2 Analyze the Fluid flow and Classification,	3	2	2	1	1	2	1	2	2	1	2	3	2	2	2	1
CO3 Learning about Flow through orifices,	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2

mouthpieces, notches and weirs;																
CO4 Acquire the knowledge about Dimensional analysis	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO5 Acquire the knowledge about Turbines and pumps	2	2	2	-	1	1	3	1	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	**SOs 1-5**	4	Units and dimensions; Properties of fluids; Static pressure of liquids: Hydraulic pressure, absolute and gauge pressure, pressure head of a liquid; Pressure on vertical rectangular surfaces; Flow behavior of viscous foods; Compressible and non-compressible fluids; Surface tension, capillarity; Pressure measuring devices: Simple, differential, micro-, inclined manometer, mechanical gauges, piezometer; Floating bodies: Archimedis principle, stability of floating bodies; Equilibrium of floating bodies, metacentric height;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Analyze the Fluid flow and Classification,	**SOs 1-5**	4	Fluid flow: Classification, steady, uniform and non-uniform, laminar and turbulent, continuity equation; Bernoulli's theorem and its applications; Navier-Stokes equations in cylindrical co-ordinates, boundary conditions; Simple application of Navier-Stokes equation: Laminar flow between two straight parallel boundaries; Flow past through the immersed solids, packed and fluidized beds; Flow through pipes: Loss of head, determination of pipe diameter; Determination of discharge, friction factor, critical velocity;	
PO 1 to 12 and PSO 1 to 4	CO3: Learning about Flow through orifices, mouthpieces, notches and weirs;	**SOs 1-5**	4	Flow through orifices, mouthpieces, notches and weirs; Vena contracta, hydraulic coefficients, discharge losses; Time for emptying a tank; Loss of head due to contraction, enlargement at entrance and exit of pipe; External and internal mouthpieces, types of notches, rectangular and triangular notches, rectangular weirs; Venturimeters, pitot tube, rotameter; Water level point gauge, hook gauge;	
PO 1 to 12 and PSO 1 to 4	CO4: Acquire the knowledge about Dimensional analysis	**SOs 1-5**	4	Dimensional analysis: Buckingham's theorem application to fluid flow phenomena, Froude Number, Reynolds number, Weber number and hydraulic similitude;	

PO 1 to 12 and PSO 1 to 4	CO5: Acquire the knowledge about Turbines and pumps	**SOs 1-5**	4	Turbines and pumps: classification, centrifugal pumps, submersible pumps, reciprocating pumps, positive displacement pump; Centrifugal pumps: Pumps in series and parallel, basic equations applied to centrifugal pump, loss of head due to changed discharge, static head, total head, manometric head, manometer efficiency, operating characteristics of centrifugal pumps, Submersible pumps; Reciprocating pumps: Working of reciprocating pump, double acting pump, instantaneous rate of discharge, acceleration of piston and water, gear pump; Pressure variation, work efficiency; Pressure requirements for viscous foods to lift them to different heights and selection of pumps; Open channel hydraulics: Classification of open channel and definitions, most economical sections of regular cross-sections; Specific energy concept-critical depth, energy diagrams; Velocity and pressure profiles in open channels; Hydraulic jumps-types.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54FT223
Course Title :	Food Thermodynamics
Pre- requisite:	Student should have basic knowledge of physics and basic laws. Understanding concepts such as energy, heat and basic principles of chemical reactions is crucial.
Rationale:	The rationale of Engineering Thermodynamics primarily revolves around enhancing efficiency in engineering systems. By understanding energy transfer, conversion, and limitations through thermodynamic principles, engineers can optimize designs, reduce energy losses, and create more efficient systems. This focus on efficiency drives innovation and ensures sustainable practices in various industries, ultimately aiming for better resource utilization and cost-effectiveness in engineering applications.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT223.1	Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.
54FT223.2	Acquire the knowledge about Second law of thermodynamics
54FT223.3	Understanding about the Thermodynamic cycles
54FT223.4	Learning about Psychometry
54FT223.5	Acquire the knowledge about Three stages of water

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT223	Food Thermodynamics	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT223	Food Thermodynamics	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT223.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1. 1 Grasp macroscopic and microscopic viewpoints, the continuum concept, and distinctions among system, surrounding, and boundary. **SO1.2** Identify thermal, chemical, mechanical, and thermodynamic equilibrium, differentiating control volume and systems approaches. **SO1.3** Differentiate intensive and extensive properties, understand state-path-process-cycle concepts, and distinguish point and path functions. **SO1.4** Explore energy fundamentals, sources, forms, and mechanisms like work and heat transfer **SO1.5** Understand the Zeroth Law, temperature scales, and equations of state, focusing on the ideal gas equation and gas constants.	1 To verify the Boyle's law. 2 To determine Joule Thomson coefficient of Carbon dioxide	1.Basic concepts: definitions, approaches, thermodynamic systems, 2.Thermodynamic properties and equilibrium, 3.State of a system, state diagram, path and process, different modes of work, 4.Zeroth law of thermodynamics, concept of temperature, heat; 5.First law of thermodynamics: Energy, enthalpy, specific heats, applications of first law, 6.Steady and unsteady flow analysis;	Different conditions of equilibrium

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT223.2:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-2**	**Self Learning (SL)**
SO2.1 Explore : Kelvin-Planck and Clausius statements, reversible and irreversible processes, thermodynamic temperature scale, entropy, **SO2.2** Analyze Properties of Pure Substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases, P-V-T **SO2.3** Understand ideal gas equation, real gas deviations, Vander Waals equation, and limitations with corresponding states **SO2.** 4 thermodynamic temperature scale, entropy, availability and irreversibility; **SO2.5** Apply thermodynamics to real systems, addressing ideal gas limitations and evaluating constants for non-ideal gases.	1. To study Mountings & Accessories of a Boiler. 2. To study the Cochran Boiler and it's Accessories and Mountings	1.Second law of thermodynamics: Kelvin-Planck and Clausius statements, 2.Reversible and irreversible processes, 3.Thermodynamic temperature scale, entropy, availability and irreversibility; 4.Thermodynamic properties of pure substances in solid, liquid and vapor phases, 5.P-V-T behaviour of simple compressible substances, 6.Phase rule;	Application of first law of thermodynamics to Open Systems like Steam Nozzle, Boiler, Steam Turbine

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT223.3:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-3**	**Self Learning (SL)**
SO3.1 Grasp the knowledge about Carnot vapor power cycle,. **SO3.2** To study the standard Otto cycle, air standard Diesel cycle, **SO3.**3 To study the air-standard Otto cycle **SO3.4** Understand Clausius inequality, theorem, and the concept that entropy is a property of a system. **SO3.5** To study the ideal Rankine cycle,	1. Study the Rankine cycle, 2. To study a Simple Steam Engine.	1.Thermodynamic cycles: Carnot vapor power cycle, 2.Ideal Rankine cycle, 3.Rankine Reheat cycle, air 4.Standard Otto cycle, air 5.Standard Diesel cycle, air-standard Brayton cycle, 6.Vapor-compression refrigeration cycle;	Limitation of first law of thermodynamics, Thermal Reservoir – Source and Sink

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT223.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding about thermodynamic properties of moist air, **SO4.2** Understanding about perfect gas relationship, absolute humidity, relative humidity, percentage humidity, humid volume, **SO4.3** Understanding about total heat, enthalpy, dry bulb temperature, wet bulb temperature, dew point temperature, **SO4.4** Understanding about adiabatic processes, wet bulb depression, humid heat, specific volume, **SO4.5** Understanding about heating, cooling, dehumidifying, sorption isotherms, finite temperature difference.	1. To study a Simple Steam Engine With D-Slide Valve. 2. To study Meyer's Expansion Valve of Steam Engine.	1.Psychometry: thermodynamic properties of moist air, perfect gas relationship, 2.Absolute humidity, relative humidity, percentage humidity, humid volume, 3.Total heat, enthalpy, dry bulb temperature, wet bulb temperature, dew point temperature, 4.Adiabatic processes, wet bulb depression, humid heat, 5.Specific volume, heating, cooling, 6.Dehumidifying, sorption isotherms,	Properties of Pure Substance: Pure substance and Phase changes

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT223.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Grasp the knowledge about Three stages of water, phase diagram for water, **SO5.2** Learning about vapour pressure-temperature curve for water, heat requirement for vaporization, cycles **SO5.3** Understanding about measurement of humidity, **SO5.4** learning about the Properties of steam: **SO5.**5 Learning about the Wet, dry saturated, Super heated steam, use of steam tables.	1. To study Drop Valve of Steam Engine 2. To study the steam table	1.Three stages of water, phase diagram for water, 2.Vapour pressure-temperature curve for water, 3.Heat requirement for vaporization, 4.Measurement of humidity, 5.Properties of steam: Wet, dry saturated, 6.Super heated steam, use of steam tables.	Properties of steam: Wet, dry saturated, Super heated steam, use of steam tables.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT223.1: Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.	6	4	1	1	12
54FT223.2: Acquire the knowledge about Second law of thermodynamics	6	4	1	1	12
54FT223.3: Understanding about the Thermodynamic cycles	6	4	1	1	12
54FT223.4:Learning about Psychometry	6	4	1	1	12
54FT223.5: Acquire the knowledge about Three stages of water	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.	03	05	02	10
CO-2	Acquire the knowledge about Second law of thermodynamics	02	06	02	10
CO-3	Understanding about the Thermodynamic cycles	02	07	01	10
CO-4	Learning about Psychometry	02	04	04	10
CO-5	Acquire the knowledge about Three stages of water	02	05	03	10
Total		11	27	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Thermodynamics will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Thermodynamics,	Yunus A. Cengel and Michael ABoles	TMH	7th Edition, 2018
2	Basic Engineering Thermodynamics	Rayner Joel,	Longman Publishers Engineering	5th Edition, 2016
3	Thermodynamics	P K Nag	TMH	5st Edition, 2015
4	Thermodynamics	Onkar Singh,	New Age International	6st Edition, 2017

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT223
Course Title: Food Thermodynamics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO2Acquire the knowledge about Second law of thermodynamic s:	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3Understand ing about the Thermodynamic	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2

cycles:																
CO4Learning about Psychometry	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO5Acquire the knowledge about Three stages of water	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Grasp fundamental thermodynamic concepts, systems, energy forms, and basic processes.	**SOs 1-5**	4	Basic concepts: definitions, approaches, thermodynamic systems, thermodynamic properties and equilibrium, state of a system, state diagram, path and process, different modes of work, Zeroth law of thermodynamics, concept of temperature, heat; First law of thermodynamics: Energy, enthalpy, specific heats, applications of first law, steady and unsteady flow analysis;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Acquire the knowledge about Second law of thermodynamics:	**SOs 1-5**	4	Second law of thermodynamics: Kelvin-Planck and Clausius statements, reversible and irreversible processes, thermodynamic temperature scale, entropy, availability and irreversibility; Properties of Pure Substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases, P-V-T behaviour of simple compressible substances, phase rule;	
PO 1 to 12 and PSO 1 to 4	CO3: Understanding about the Thermodynamic cycles:	**SOs 1-5**	4	Thermodynamic cycles: Carnot vapor power cycle, ideal Rankine cycle, Rankine Reheat cycle, air standard Otto cycle, air standard Diesel cycle, air-standard Brayton cycle, vapor-compression refrigeration cycle;	
PO 1 to 12 and PSO 1 to 4	CO4: Learning about Psychometry	**SOs 1-5**	4	Psychometry: thermodynamic properties of moist air, perfect gas relationship, absolute humidity, relative humidity, percentage humidity, humid volume, total heat, enthalpy, dry bulb temperature, wet bulb temperature, dew point temperature, adiabatic processes, wet bulb depression, humid heat, specific volume, heating, cooling, dehumidifying, sorption isotherms,	
PO 1 to 12 and PSO 1 to 4	CO5: Acquire the knowledge about Three stages of water	**SOs 1-5**	4	Three stages of water, phase diagram for water, vapour pressure-temperature curve for water, heat requirement for vaporization, measurement of humidity, Properties of steam: Wet, dry saturated, superheated steam, use of steam tables.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- II

Course Code:	54AE228
Course Title :	Post Harvest Engineering
Pre- requisite:	Students should have basic knowledge of Overview of post harvest technology and different unit operation for value addition of Finished product.
Rationale:	The students studying Post Harvest Engineering i.e. a scientific discipline that focuses on the present scenario of post harvest production Post harvest losses, which are generally found during handling operation of food. The field is comprises about classification of different unit operation in food that applicable for Processing of food

Course Outcomes (CO):

Course Code	Course Outcomes
54AE228.1	Overview of postharvest technology: Concept and importance of Post Harvest Engineering.
54AE228.2	Explain the basic concept of cleaning and grading of grain after harvesting process along with their equipments.
54AE228.3	Acquire the knowledge for grain separator and grain drying theory.
54AE228.4	Explain the concept of paddy parboiling, their methods and briefly discuss about pulse and oil milling.
54AE228.5	Explain about different types of material handling equipments that applicable for convey of grain.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54AE228	Post Harvest Engineering	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54AE 228	Post Harvest Engineering	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54AE228.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1Understand the overview of post harvest technology along with Concept and science SO1.2 Understand production and post harvest losses, reasons for losses, importance of loss reduction SO1.3Understanding the Water activity, water binding and its effect on enzymatic and non-enzymatic reactions SO1.4 Control of water activity and moisture content SO1.5 Understanding the Post Harvest Handling operations.	1.To study about importance of post harvest engineering 2.To study about different causes of postharvest losses	1. Overview of post harvest technology 2. Post harvest losses 3. Water activity 4. Control of water activity 5. Post Harvest Handling operations;	1. knowledge about various technique for post harvest management 2.Importance and scope of post harvest engineering

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54AE228.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the Cleaning of grains, washing of fruits and vegetables, types of cleaners SO2.2 Understand screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables SO2.3Understanding the cleaning efficiency, care and maintenance; Sorting and grading: Sorting, grading, methods of grading; SO2.4Understanding the Grading- Size grading, colour grading, specific gravity grading SO2.5 Understanding the screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance;	1. Introduction to different cleaning equipments for grain 2. Introduction to different types of grain separator.	1.Cleaning of grains, washing of fruits and vegetables, 2.Types of cleaners, screens, types of screens, rotary screens, vibrating screens, 3.Machinery for cleaning of fruits and vegetables (air cleaners, washers), 4. Cleaning efficiency, care and maintenance; 5.Sorting, grading, methods of grading; 6.Grading- Size grading, colour grading, specific gravity grading; screening, 7.Equipment for grading of fruits and vegetables, grading efficiency, care and maintenance;	Knowledge about principle of air screen cleaner. Detailed study about working principle of magnetic seperator.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54AE228.3:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-3**	**Self Learning (SL)**
SO3.1 Understand Magnetic separator, destoners, electrostatic separators, pneumatic separator SO3.2 Understand Decorticating and shelling: Principles of working, design and constructional details SO3.3 Understanding operating parameters, maintenance, etc. of various decorticators, dehullers, shellers, SO3.4 Understanding description of groundnut decorticators, maize shellers SO3.5 Understanding Grain drying theory, grain dryers; Liquid dryers.	Introduction to working principle of groundnut decorticator. Introduction to different types of grain dryers.	1.Magnetic separator, destoners, electrostatic separators, pneumatic separator; 2. Decorticating and shelling: Principles of working, design and constructional details, 3. Operating parameters, maintenance, etc. of various decorticators/dehullers/shellers, 4. Description of groundnut decorticators, maize shellers, etc.; 5. Grain drying theory, 6. Grain dryers; Liquid dryers;	Knowledge about working principle of destoner. Knowledge about different types of dryer.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54AE228.4

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand Parboiling: process, changes during parboiling, parboiling methods, advantages and disadvantages of parboiling with respect to milling. SO4.2 Understand nutritional and cooking quality of grain, significance of glass transition temperature; SO4.3 Understanding Milling: milling, polishing, grinding, milling equipments, dehuskers, polishers (abrasion, friction, water jet), flour milling machines SO4.4 Understanding pulse milling machines, grinders, cutting machines SO4.5 Understanding oil expellers, machine efficiency and power requirement;	Introduction to parboiling of paddy To study about different methods of pulse milling	1.Parboiling: process, changes during parboiling, parboiling methods 2. Advantages and disadvantages of parboiling with respect to milling, 3. Nutritional and cooking quality of grain, significance of glass transition temperature; 4. Milling: milling, polishing, grinding, milling equipments, dehuskers, polishers (abrasion, friction, water jet), 5. Flour milling machines, pulse milling machines, grinders, cutting machines, 6. Oil expellers 7. Machine efficiency and power requirement;	Knowledge about various method of parboiling. Detailed information about oil milling.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54AE228.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Materials handling: Introduction to different conveying equipments used for handling of grains, fruits and vegetables SO5.2 Understand Scope and importance of material handling devices; Study of different material handling systems: Classification, principles of operation, conveyor System SO5.3 Understanding Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper SO5.4 Understanding Chain conveyor: Principle of operation, advantages, disadvantages, capacity and speed, conveying chain; Screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge SO5.5 Understanding Bucketelevator: Principle, classification,	Introduction to different types of material handling equipments. To study about working principle of bucket elevator.	1.Introduction to different conveying equipments used for handling of grains, fruits and vegetables 2.Classification, principles of operation, conveyor system, Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity 3.Chain conveyor: Principle of operation, capacity and speed, Screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge 4.Bucket elevator: Principle, classification, operation, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge 5. Pneumatic conveying system: Capacity and power requirement, types, air/product separators; Gravity conveyor design considerations, capacity and power requirement.	Knowledge about various design techniques in material handling equipments. Knowledge about working principle of belt conveyor.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54AE228.1: Overview of postharvest technology: Concept and importance of Post Harvest Engineering.	5	4	1	1	11
54AE228.2: Explain the basic concept of cleaning and grading of grain after harvesting process along with their equipments.	7	4	1	1	13
54AE228.3: Acquire the knowledge for grain separator and grain drying theory.	6	4	1	1	12
54AE228.4: Explain the concept of paddy parboiling, their methods and briefly discuss about pulse and oil milling.	7	4	1	1	13
54AE228.5: Explain about different types of material handling equipments that applicable for convey of grain.	5	4	1	1	11
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Overview of postharvest engineering	03	03	01	07
CO-2	Different types of cleaning and grading equipments	03	05	02	10
CO-3	Grain separators and drying theory	02	06	03	11
CO-4	Paddy parboiling and concept of milling	03	04	04	11
CO-5	Material handling equipments	02	04	05	11
Total		13	22	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Post Harvest Engineering will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Post Harvest Technology and Food Process Engineering	Amalendu Chakraverty and R. Paul Singh	CRC Press, Boca Raton, FL, USA	2014
2	Post Harvest Technology of Cereals, Pulses and Oilseeds	A. Chakraverty	Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi	3rd Ed., 2008
3	Unit Operations of Agricultural Processing	K.M. Sahay and K.K. singh	Vikas Publishing House Pvt. Ltd., Noida, UP	2001
4	Food Processing Handbook	James G. Brennan	Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany	2006

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54AE228
Course Title: Post Harvest Engineering

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Overview of postharvest engineering	2	1	3	1	1	3	2	3	1	3	1	1	3	3	3	3
CO:2 Different types of cleaning and grading equipments	3	3	2	1	3	1	3	1	2	1	1	3	3	3	3	3
CO:3 Grain separators and drying theory	3	3	1	1	3	1	3	1	2	2	1	3	3	3	3	3
CO:4 Paddy parboiling and concept of	3	1	3	1	3	1	3	1	2	3	1	3	3	3	3	3

milling																
CO:5 Material handling equipments	3	1	2	1	3	1	2	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Overview of postharvest engineering	**SOs 1-5**	4	Overview of post harvest technology: Concept and science, production and post harvest losses, reasons for losses, importance of loss reduction; Water activity, water binding and its effect on enzymatic and non-enzymatic reactions and food texture, control of water activity and moisture; Post Harvest Handling operations;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Different types of cleaning and grading equipments	**SOs 1-5**	4	Cleaning: Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Sorting and grading: Sorting, grading, methods of grading; Grading- Size grading, colour grading, specific gravity grading; screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance;	
PO 1 to 12 and PSO 1 to 4	CO3: Grain separators and drying theory	**SOs 1-5**	4	Separation: Magnetic separator, destoners, electrostatic separators, pneumatic separator; Decorticating and shelling: Principles of working, design and constructional details, operating parameters, maintenance, etc. of various decorticators/dehullers/shellers, description of groundnut decorticators, maize shellers, etc.; Grain drying theory, grain dryers; Liquid dryers;	
PO 1 to 12 and PSO 1 to 4	CO4: Paddy parboiling and concept of milling	**SOs 1-5**	4	Parboiling: process, changes during parboiling, parboiling methods, advantages and disadvantages of parboiling with respect to milling, nutritional and cooking quality of grain, significance of glass transition temperature; Milling: milling, polishing, grinding, milling equipments, dehuskers, polishers (abrasion, friction, water jet), flour milling machines, pulse milling machines, grinders, cutting machines, oil expellers,	

				machine efficiency and power requirement;	
PO 1 to 12 and PSO 1 to 4	CO5: Material handling equipments	**SOs 1-5**	4	Materials handling: Introduction to different conveying equipments used for handling of grains, fruits and vegetables; Scope and importance of material handling devices; Study of different material handling systems: Classification, principles of operation, conveyor system selection/design; Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper; Chain conveyor: Principle of operation, advantages, disadvantages, capacity and speed, conveying chain; Screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors; Bucket elevator: Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge, buckets types; Pneumatic conveying system: Capacity and power requirement, types, air/product separators; Gravity conveyor design considerations, capacity and power requirement.	

Semester-I

Course Code: **IKS**

Course Title: Fundamentals of Indian Knowledge System

Pre- requisite: Creating awareness among the youths about the true history and past rich culture of India.

Rationale: India has very rich and versatile knowledge system and cultural heritage since antiquity. The Indian Knowledge systems was developed on life science, medical science, literature, drama, art, music, dance, astronomy, mathematics, architecture (Sthapatyaveda), chemistry, aeronautics etc, during ancient period. In this basic course, a special attention is given to the ancient and historical perspective of ideas occurrence in the ancient society, and implication to the concept of material world and religious, social and cultural beliefs. On the closer examination, religion, culture and science have appeared epistemological very rigidly connected in the Indian Knowledge System. This land of Bharat Bhumi has provided invaluable knowledge stuff to the society and the world in all sphere of life.

Course Outcomes:

CO- IKS. 1: To understand the ancient civilization, Indian Knowledge Systems, Concept of Panch Mahabhuta, Origin of name Bharat Varsha, Ancient Rivers, Ancient Universities and ancient agriculture.

CO- IKS.II: Students will have the ability to learn about ancient books, Religious places, basic concept of Indian dance, music and arts, and fundamental aspects of Sangeeta and Natyashashtra etc.

CO- IKS.III: Student will be able to gain knowledge on Vedic Science, Astronomy, Astrovastu, Vedic Mathematics, Aeronautics, Metallurgy, Nakhatras, Panchang, Concept of Zero, Pi and point etc.

CO- IKS. IV: Understanding on ancient Engineering, Science and Technology, Town Planning, Temple architecture, Chemistry and Metallurgy, Metal manufacturing etc.

CO- IKS. V: Student will able to understand about the Life, Nature and Health through basic concept of Ayurveda andYoga, Traditional Medicinal Systems, Ethnomedicine, Nature conservation, World Heritage Sites etc.

Scheme of Studies:

Category of Course	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
VAC	IKS	Indian Knowledge System	2		1	1	4	2

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Session Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Proposed examination scheme (Marking) as per the recommendation of University Grant Commission (UGC) for Under Graduate Courses in Fundamentals of Indian Knowledge Systems 2022-23 onwards

S. No.	Category of Course/Subject	Components of Marks				Total
		Semester End Examination (External	Mid Term exam (Internal)	Assignment (Internal)	Practical Exam (Internal)	
1	Only Theory Subject Course					
2	Subject/ Course with theory and Practical					
3	Subject/ Course only Practical					

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

IKS. 1. To understand Indian Civilization and Indian Knowledge Systems

Approximate Hours

Item	Approximate Hours
CI	**6**
LI	
SW	**2**
SL	**1**
Total	**9**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1. Understand Overview of Indian Knowledge Systems (IKS) SO 1.2. Understand Classification of Ancient IKS texts SO 1.3. Understand Introduction to Panch Mahabhutas (Earth, Water, Fire, Sky and Air) SO 1.4. Understand Origin of the name Bharatvarsha: the Land of Natural Endowments SO 1.5. Understand Rivers of ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) SO 1.6. Understand Ancient Agriculture and ancient Universities: Takshashila and Nalanda, Gurukul system		**Unit-1. Indian Civilization and Indian Knowledge Systems** 1.1.Overview of Indian Knowledge Systems (IKS) 1.2 Classification of Ancient IKS texts 1.3 Introduction to Panch Mahabhutas (Earth, Water, Fire, Sky and Air) 1.4 Origin of the name Bharatvarsha: the Land of Natural Endowments 1.5 Rivers of ancient India (The Ganga, Yamuna, Godawari, Saraswati, Narmada, Sindhu and Kaveri) 1.6 Agriculture system in ancient India, Ancient Universities: Takshashila and Nalanda, Gurukul system	Golden era of ancient India

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Concepts of Panch Mahabhuta, Classification of ancient texts, origin of ancient rivers

b. Mini Project:

i. Ancient Universities: Takshashila and Nalanda,

c. Other Activities (Specify):

IKS. 2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places

Approximate Hours

Item	Approximate Hours
CI	**6**
LI	
SW	**2**
SL	**1**
Total	**9**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1. Understand the Ancient Indian Books: Vedas, Puranas, Shastras, Upanishads, Mahakavyas (Ramayana & Mahabharata), Smrities, Samhitas SO 2.2. Understand the Religious places: Puries, Dhams, Jyotiralinga, Shaktipeeths, Kumbha Mela SO 2.3. Understand the Legendary places of Madhya Pradesh: Ujjain, Chitrakoot, Omkareshwar, Bharhut, Maihar SO 2.4. Understand the Basic concept of Indian Art, Music and Dance, Indian Musical Instruments SO 2.5. Understand the Fundamental aspects of Sangeeta and Natya shastra SO 2.6. Understand the different schools of music, dance and painting in different regions of India		**Unit-2. Indian Art, Literature and Religious Places** 2.1. Ancient Indian Books: Vedas, Puranas, Shastras, Upanishads, Mahakavyas (Ramayana & Mahabharata), Smrities, Samhitas 2.2. Religious places: Puries, Dhams, Jyotiralinga, Shaktipeeths, Kumbha Mela 2.3. Legendary places of Madhya Pradesh: Ujjain, Chitrakoot, Omkareshwar, Bharhut, Maihar 2.4. Basic concept of Indian Art, Music and Dance, Indian Musical Instruments 2.5. Fundamental aspects of Sangeeta and Natya shastra 2.6. Different schools of music, dance and painting in different regions of India	**1.** Indian Art, Music and Dance

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Visit of Chitrakoot, Maihar and Bharhuta

b. Mini Project:

ii. Kumbhmela, Story of Ramayana and Mahabharata

c. Other Activities (Specify):

IKS. 3: Student will be able to understand Ancient Science, Astronomy and Vedic Mathematics

Approximate Hours

Item	Approximate Hours
CI	**6**
LI	
SW	**2**
SL	**1**
Total	**9**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1. Understand Vedic Cosmology SO 3.2. Understand the Astronomy, Astrovastu, Vedang Jyotish, Nakshatras, Navagraha, Rashis, Vastushastra and their related plants SO 3.3. Understand the Time and Calendar, Panchang SO 3.4. Understand the Concept of Zero, Point, Pi -number system, Pythagoras SO 3.5. Understand the Vedic Mathematics, Vimana-Aeronautics, Basic idea of planetary model of Aryabhatta SO 3.6. Understand the Varanamala of Hindi		**Unit-3. Ancient Science, Astronomy, Mathematics** 3.1. Vedic Cosmology 3.2. Astronomy, Astrovastu, Vedang Jyotish, Nakshatras, Navagraha, Rashis, Vastushastra and their related plants 3.3. Time and Calendar, Panchang 3.4. Concept of Zero, Point, Pi -number system, Pythagoras 3.5. Vedic Mathematics, Vimana-Aeronautics, Basic idea of planetary model of Aryabhatta 3.6. Varanamala of Hindi language based on classification of sounds	1. Ancient Science, Astronomy and Vedic Mathematics

language based on classification of sounds on the basis of their origin, Basic purpose of science of Vyakarana		on the basis of their origin, Basic purpose of science of Vyakarana.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Varanamala of Hindi language based on classification of sounds on the basis of their origin

b. Mini Project:

1. Nakshatras, Navagraha and their related plants

c. Other Activities (Specify):

IKS. 4: Understand the Engineering, Technology and Architecture

Approximate Hours

Item	Approximate Hours
CI	**6**
LI	
SW	**2**
SL	**1**
Total	**9**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1. Understand the Engineering Science and Technology in Vedic and Post Vedic Era SO 4.2. Understand the Town and Home planning, Sthapatyaveda SO 4.3. Understand the Chemistry and Metallurgy as gleaned from archeological artifacts SO 4.4. Understand the Chemistry of Dyes, Pigments used in Paintings, Fabrics, Potteries and Glass		**Unit-4. Engineering, Technology and Architecture** 4.1.Engineering Science and Technology in Vedic and Post Vedic Era 4.2.Town and Home planning, Sthapatyaveda 4.3.Chemistry and Metallurgy as gleaned from archeological artifacts 4.4 Chemistry of Dyes, Pigments used in Paintings, Fabrics,	2. Ancient Science, Astronomy and Vedic Mathematics

SO 4.5. Understand the Temple Architecture: Khajuraho, Sanchi Stupa, Chonsath Yogini temple SO 4.6. Understand the Mining and manufacture in India of Iron, Copper, Gold from ancient times		Potteries and Glass 4.5.Temple Architecture: Khajuraho, Sanchi Stupa, Chonsath Yogini temple 4.6.Mining and manufacture in India of Iron, Copper, Gold from ancient times	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Varanamala of Hindi language based on classification of sounds on the basis of their origin

b. Mini Project:

i. Nakshatras, Navagraha and their related plants

c. Other Activities (Specify):

IKS. 5: Understand about the Life, Nature and Health

Approximate Hours

Item	Approximate Hours
CI	**6**
LI	
SW	**2**
SL	**1**
Total	**9**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1. Understand the Fundamentals of Ayurveda (Charaka & Shushruta) and Yogic Science (Patanjali), Ritucharya and Dinacharya SO 5.2. Understand the Traditional system of Indian medicines (Ayurveda, Siddha, Unani and Homoeopathy) SO 5.3. Understand Fundamentals of		**Unit-5. Life, Nature and Health** 5.1.Fundamentals of Ayurveda (Charaka & Shushruta) and Yogic Science (Patanjali), Ritucharya and Dinacharya 5.2. Traditional system of Indian medicines (Ayurveda, Siddha, Unani and Homoeopathy)	1. Concept of Ayurveda and Yoga 2. Traditional system of Indian medicines 3. Ethnobotany and Ethnomedicines of India

Ethnobotany and Ethnomedicines of India SO 5.4. Understand the Nature Conservation in Indian ancient texts SO 5.5. Understand the Introduction to Plant Science in Vrikshayurveda SO 5.6. Understand the World Heritage Sites of Madhya Pradesh: Bhimbetka, Sanchi, Khajuraho		5.3.Fundamentals of Ethnobotany and Ethnomedicines of India 5.4.Nature Conservation in Indian ancient texts 5.5 Introduction to Plant Science in Vrikshayurveda 5.6.World Heritage Sites of Madhya Pradesh: Bhimbetka, Sanchi, Khajuraho	4. World Heritage Sites

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Visit to world Heritage Site Khajuraho

b. Mini Project:

i. Ritucharya and Dincharya, Ethnomedicinal plants

c. Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
IKS. 1: To understand Indian Civilization and Indian Knowledge Systems	**6**	**2**	**1**	**9**
IKS. 2: Students will have the ability to apply the knowledge gained about Indian Art, Literature and Religious Places	**6**	**2**	**1**	**9**
IKS. 3: Student will be able to understand the Ancient Science, Astronomy and Vedic Mathematics	**6**	**2**	**1**	**9**
IKS. 4: Understand the Engineering, Technology and Architecture	**6**	**2**	**1**	**9**
IKS. 5: Understand about the Life, Nature and Health	**6**	**2**	**1**	**9**
Total	**30**	**10**	**5**	**45**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Indian Civilization and Indian Knowledge	**2**	**5**	**1**	**8**

	Systems				
CO 2	Indian Art, Literature and Religious Places	**2**	**6**	**2**	**8**
CO 3	Ancient Science, Astronomy and Vedic Mathematics	**2**	**6**	**5**	**13**
CO 4	Engineering, Technology and Architecture	**2**	**4**	**4**	**10**
CO 5	Life, Nature and Health	**2**	**5**	**2**	**9**
Total		**10**	**26**	**14**	**50**

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for **Indian Knowledge Systems** will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course teacher for above tasks. Teacher can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Religious places, World Heritage Sites
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	**Title**	**Author**	**Publisher**	**Edition & Year**
1	*An Introduction of Indian Knowledge Systems: Concept and Applications*	Mahadevan, B.; Bhat V. R. and Pavana, Nagendra R. N.	Prentice Hall of India.	2022
2	*Indian Knowledge Systems*: Vol. I and II.	Kapoor, Kapil and Singh, A. K.	D.K. Print World Ltd	2005
3	*Science of Ancient Hindus: Unlocking Nature in Pursuit of Salvation*	Kumar, Alok	Create pace Independent Publishing	2014
4	*A History of Agriculture in India*	Randhava, M.S.	ICAR, New Delhi	1980

5	*Panch Mahabhuta,*	Yogcharya, Jnan Dev	Yog Satsang Ashram	2021
6	*The Indian Rivers*	Singh, Dhruv Sen	Springer	2018
7	*The Wonder That Was India*	Basam, Arthue Llewllyn	Sidgwick & Jackson	1954
8	*Ancient Cities, Sacred Skies: Cosmic Geometries and City Planning in Ancient India*	Malville, J. MacKim & Gujaral, Lalit M.	IGNCA & Aryan Books International, New Delhi	2000
9	*The Natya Shastra of Bharat Muni*	Jha, Narendra	Innovative Imprint, Delhi	2023
10	*Astronomy in India: A Historical Perspective*	Padmanabhan, Thanu	Indian National Science Academy, New Delhi & Springer (India).	2010
11	*History of Astronomy in India* 2nd Ed.	Sen, S.N. and Shukla, K.S.	INSA New Delhi	2001
12	*History of Indian Astronomy A Handbook*	Ramasubramanian, K.; Sule, Aniket and Vahia, Mayank	Science and Heritage Initiative, I.I.T. Mumbai and Tata Institute of Fundamental Research, Mumbai	2016
13	*Indian Mathematics and Astronomy: Some Landmarks*	Rao, Balachandra S.	Jnana Deep Publications, Bangalore, 3rd Edition	. 2004
14	*Vedic Mathematics and Science in Vedas*	Rao, Balachandra S.	Navakarnataka Publications, Bengaluru	2019
15	*A History of Hindu Chemistry*	Ray, Acharya Prafulla Chandra	Repbl Shaibya Prakashan Bibhag, Centenary Edition, Kolkata	1902
16	*Early Indian Architecture: Cities and City Gates*	Coomeraswamy, Anand	Munciram Manoharlal Publishers	2002
17	*Theory and Practices of Temple Architecture in Medieval India: Bhojas samrangasutradhar and the Bhojpur Line Drawings*	Hardy, Adams	Dev Publishers & Distributors.	2015
18	*Indian Science and Technology in Eighteenth Century*	Dharmpal	Academy of Gandhian Studies, Hyderabad.	1971
19	*Science in India: A Historical Perspective*	Subbarayappa, B.V.	Rupa New Delhi	2013

20	*Fine Arts & Technical Sciences in Ancient India with special reference to Someswvara's Manasollasa*	Mishra, Shiv Shankar	Krishnadas Academy, Varanasi	1982
21	*Fundamental Principles of Ayurveda*, Volume One	Lad, Vasant D.	The Ayurvedic Press, Alboquerque, New Mexico.	2002
22	*Charak Samhita*, Chaukhamba	Pandey, Kashinath and Chaturvedi Gorakhnath	Vidya Bhawan, Varanasi	
23	*Ayurveda: The Science of Self-Healing*	Lad, Vasant D.	Lotus Press: Santa Fe	1984
24	*Ayurveda: Life, Health and Longevit*	Svoboda, Robert E	Penguin: London	1992
25	*Plants in the Indian Puranas*	Sensarma, P.	Naya Prokash, Calcutta	1989
26	*Indian Cultural Heritage Perspective for Tourism*	Singh, L. K.	Gyan Publishing House, Delhi	2008
27	*Glimpses of Indian Ethnobotany*	Jain, S.K.	Oxford & IBH Publishing Company Private Limited, New Delhi	1981
28	Manual of Ethnobotany	Jain, S.K.	Scientific Publishers, Jodhpur	2010

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Cos,POs and PSOs Mapping

Programme Title: …….

Course Code: IKS

Course Title: Fundamentals of Indian Knowledge System

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO-1: To understand the ancient civilization, Indian Knowledge Systems, Concept of Panch Mahabhuta, Origin of name Bharat Varsha, Ancient Rivers, Ancient Universities and ancient agriculture.																
CO-2: Students will have the ability to learn about ancient books, Religious places, basic concept of Indian dance, music and arts, and fundamental aspects of Sangeeta and Natyashashtra etc.																
CO-.3: Student will be able to gain knowledge on Vedic Science, Astronomy, Astrovastu, Vedic Mathematics, Aeronautics, Metallurgy, Nakhatras, Panchang, Concept of Zero, Pi and point etc.																
CO- 4: Understanding on ancient Engineering, Science and Technology, Town Planning, Temple architecture, Chemistry and Metallurgy, Metal manufacturing etc.																
CO- 5: Student will able to understand about the Life, Nature and Health through basic concept of Ayurveda andYoga, Traditional Medicinal Systems, Ethnomedicine, Nature conservation, World Heritage Sites etc.																

Legend:1–Low,2–Medium, 3–High

Course Curriculum Map:

POs & PSOs No.	Cos No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO-1:** To understand the ancient civilization, Indian Knowledge Systems, Concept of Panch Mahabhuta, Origin of name Bharat Varsha, Ancient Rivers, Ancient Universities and ancient agriculture.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1**: Indian Civilization and Indian Knowledge Systems 1.1,1.2,1.3,1.4,1.5,1.6	As mentioned
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO-2:** Students will have the ability to learn about ancient books, Religious places, basic concept of Indian dance, music and arts, and fundamental aspects of Sangeeta and Natyashashtra etc.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2:** Indian Art, Literature and Religious Places 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO-.3:** Student will be able to gain knowledge on Vedic Science, Astronomy, Astrovastu, Vedic Mathematics, Aeronautics, Metallurgy, Nakhatras, Panchang, Concept of Zero, Pi and point etc.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3**: Ancient Science, Astronomy and Vedic Mathematics 3.1, 3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO- 4:** Understanding on ancient Engineering, Science and Technology, Town Planning, Temple architecture, Chemistry and Metallurgy, Metal manufacturing etc.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**Unit-4:** Engineering, Technology and Architecture 4.1, 4.2,4.3,4.4,4.5,4.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO- 5:** Student will able to understand about the Life, Nature and Health through basic concept of Ayurveda andYoga, Traditional Medicinal Systems, Ethnomedicine, Nature conservation, World Heritage Sites etc.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: **Life, Nature and Health** 5.1,5.2,5.3,5.4,5.5,5.6	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54MS321
Course Title :	Engineering Mathematics-II
Pre- requisite:	Higher knowledge of mathematics.
Rationale:	The aim of the course is to introduce to the field of mathematics with emphasis on its use to solve real world problems for which solutions are difficult to express using the different methods. It explores the essential theory behind methods for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem-solving strategies found in nature.

Course Outcomes (CO):

Course Code	Course Outcomes
54MS321.1	Student will define the concept of matrices.
54MS321.2	Student will define the concept of limit continuity and functions.
54MS321.3	Student will define the concept of partial differential equation.
54MS321.4	Student will understand application of partial differential equation.
54MS321.5	Student will understand statistical methods and application in food processing calculations

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54MS321	Engineering Mathematics-II	2	0	1	1	4	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		Home Assignment (HA)	End Semester Exam (ESE)	Total Marks (SA1+SA2+ ESPA+ESE)
			SA1	SA2			
PCFT	54MS321	Engineering Mathematics-II	20	20	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS321.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	00	01	01	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the concept of matrices **SO1.2** Use of linear transformation	.	1.1. Elementary transformation 1.2. Rank of a matrix 1.3. Gauss Jordan method 1.4. Consistency and solution 1.5. Eigen value and Eigen vector 1.6. Diagonalisation of matrices	1.1. Matrix definition and types

SW-1Suggested Sessional Work (SW):

Assignments:

1. Numerical based on matrices.
2. Numerical based on Eigen value and Eigen vector
3. Solve related example linear transformation

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS321.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	00	01	01	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the concept Functions **SO2.2** Understand the concept of Limit	.	2.1. Functions of a complex variable 2.2. Limit and continuity 2.3. Analytic function. 2.4. Cauchy Riemann equation 2.5. Conjugate function 2.6. Fourier series Infinite series	2.1. Writes examples of limit and continuity

SW-2Suggested Sessional Work (SW):

Assignments:

1. Numerical based Function.
2. Numerical based on Limit.
3. Examples of Fourier series.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS321.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	00	01	01	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the concept of partial differential equation **SO3.2** Use even and odd function **SO3.3** Find order and degree	.	3.1. Partial differential equation 3.2. Dirichlet's conditions. 3.3. Even and odd function 3.4. Half range series 3.5. Partial differential equation 3.6. Langrange's linear equation and Nonlinear partial differential equation	3.1. Writes examples of even odd functions

SW-3 Suggested Sessional Work (SW):

Assignments:

1. Numerical based on Langranges linear equation..
2. Numerical based on Eular's formula.
3. Writes related examples partial differential equation.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS321.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	00	01	01	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understand the concept of Differential equation **SO4.2** Application of PDE **SO4.3** How to learn one and two dimensional equation.	.	4.1. Application of partial differential equation 4.2. Charpit's method and Examples of charpits method 4.4. Application of PDE 4.4. One dimensional wave 4.5. Two dimentional study 4.6. Heat flow equation	4.1. Laplace equation and Concept of one two dimensional equation

SW-4 Suggested Sessional Work (SW):

Assignments:

1. Questions based on Charpits method.
2. Questions based on application of PDE.
3. Questions based on one and two dimentional

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54MS321.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand the concept of Statistics **SO5.2** Use some applications to food calculation.	.	5.1. Statistical method 5.2. Application in food processing 5.3. Calculation Mean, Median, Mode 5.4. Correlation 5.5. Regression 5.6. Significance of correlation and regression	5.1. Writes Use of mean, median, mode.

SW-5 Suggested Sessional Work (SW):

Assignments:

1. Different types of methods
2. Writes Examples of mean, median , mode.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes		Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+SW+SL)
54MS321.1: Student will define the concept of matrices.		6	0	1	1	8
54MS321.1: Student will define the concept of limit continuity and functions.		6	0	1	1	8
54MS321.3: Student will define the concept of partial differential equation.		6	0	1	1	8
54MS321.4: Student will understand application of partial differential equation**..**		6	0	1	1	8
54MS321.4: Student will understand statistical methods and application in food processing calculations.	.	6	0	1	1	8
Total		30	00	5	5	40

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Matrices	5	3	2	10
CO-2	Functions of a complex variable	2	3	5	10
CO-3	Partial differential equation	2	3	5	10
CO-4	Application of partial differential equation	2	3	5	10
CO-5	Statistical method	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Engineering Mathematics will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill book Co., New Delhi	2008
2	Higher Engineering mathematics	B.S. Grewal	Khanna Publisher	2004
3	A text book of matrices	Shanti Narayan	S.Chand and Co. Ltd New Delhi	2004

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT321
Course Title: Engineering Mathematics II

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Student will define the concept of matrices.	3	2	2	2	2	1	1	1	1	1	1	3	2	2	3	3
CO2: Student will define the concept of limit continuity and functions.	2	3	3	2	2	2	1	1	1	1	1	3	2	3	2	3
CO3: Student will define the concept	3	2	3	3	2	2	1	1	1	1	1	3	2	2	2	3

of partial differential equation.																
CO4: Student will understand application of partial differential equation.	3	3	3	2	2	2	1	1	1	1	1	3	2	2	3	2
CO5: Student will understand statistical methods and application in food processing calculations	3	2	3	2	2	2	1	1	1	1	1	3	2	2	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Define the concept of matrices.	**SOs 1-2**	Matrices: Elementary transformations, rank of a matrix, reduction to normal form, Gauss-Jordon method to find inverse of a matrix, consistency and solution of linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem, linear transformation, orthogonal transformations, diagonalisation of matrices, bilinear and quadratic forms;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Define the concept of limit continuity and functions.	**SOs 1-2**	Functions of a complex variable: Limit, continuity and derivative of complex functions, analytic function, Cauchy-Reimann equations, conjugate functions, harmonic functions; Fourier series: Infinite series and its convergence, periodic functions, Fourier series,	
PO 1 to 12 and PSO 1 to 4	CO3: Define the concept of partial differential equation. .	**SOs 1-3**	Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series, harmonic analysis; Partial differential equations: Formation of partial differential equations, Lagrange's linear equation, higher order linear partial differential equations with constant coefficients, solution of non-linear partial differential equations,	
PO 1 to 12 and PSO 1 to 4	CO4: To understand application of partial differential equation.	**SOs 1-3**	Charpit's method, application of partial differential equations (one-dimensional wave and heat flow equations, two-dimensional steady state heat flow equation (Laplace equation).	
PO 1 to 12 and PSO 1 to 4	CO5 To understand statistical methods and application in food processing calculations.	**SOs 1-2**	Statistical methods and application in food processing calculations, Mean, Median and Mode. Correlation, regression, testing of significance of correlation and regression ,ANOVA	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54FT322
Course Title :	Fundamentals of Food Processing
Pre- requisite:	Students should have basic knowledge of various processing and preservation techniques of food.
Rationale:	The students studying Fundamentals of Food Processing should possess foundational understanding about various aspects, including food chemistry, microbiology, engineering principles, and sensory analysis. It provides a comprehensive understanding of how raw materials are transformed into safe, appealing, and nutritious food products that meet consumer demands and regulatory standards.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT322.1	Understand the knowledge of sources, types and perishability of food products.
54FT322.2	Acquired the knowledge of preservation of food by application heat.
54FT322.3	Acquired the knowledge of preservation of food by low temperature.
54FT322.4	Understand the knowledge of preservation of food by irradiation, chemicals and fermentation.
54FT322.5	Apply the knowledge of various non-thermal preservation methods of food.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT322	Fundamentals of Food Processing	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2+ ESPA+ESE)
			SA1	SA2			
PCFT	54FT322	Fundamentals of Food Processing	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT322.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand sources of food. **SO1.2** Understand about types of food. **SO1.3** Perishability of food products. **SO1.4** Causes and types of food spoilage. **SO1.**5 Methods of food preservation	1.1. Preservation of food by high concentration of sugar. 1.2. Preservation of food by using salt.	1.1 Basic definition of food, sources and types of food. 1.2 Causes and types of food spoilage, perishability definition and classification of food according to spoilage. 1.3 Scope of food preservation and benefits of food preservation. 1.4 Traditional and modern methods of food preservation. 1.5 Preservation by salt and sugar: 1.6. Principle, method and effect on food quality.	1.1. Production and processing scenario of food products in India.

SW-1 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT322.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 To Understand various methods of heat treatment. **SO2.2** To Understand about blanching. **SO2.3** To understand about canning. **SO2.4** To understand about pasteurization. **SO2.**5 To understand about sterilization.	2.1. To study about blanching of selected food product. 2.2. To study about canning of selected food product.	2.1 Definition of blanching, principle and equipments for blanching, methods of blanching. 2.2 Definition of canning, history of canning, principle and equipments for canning, methods of canning. 2.3 Defects in can and can integrity test. 2.4 History of pasteurization, working principle and Application of pasteurization. 2.5 Methods of pasteurization (LTLT, HTST, UHT) and equipments of pasteurization. 2.6. Definition of sterilization, methods of sterilization and types of sterilization (In-bottle sterilization and aseptic processing).	2.1. Effect of temperature on quality of various food products.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT322.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 To Understand about history of low temperature preservation. **SO3.2** To Understand various methods of low temperature preservation. **SO3.3** To understand preservation of food by drying. **SO3.4** To understand preservation of food by dehydration. **SO3.**5 To learn about preservation of food by concentration.	3.1. To study about the drying of selected food product. 3.2. To study about the freeze-drying of selected food product.	3.1 History of mechanical refrigeration, chilling, cooling and freezing methods of food. 3.2 Working principle and equipments used for low temperature preservation of food. 3.3 Definition of drying, working principle, equilibrium moisture content and importance of drying. 3.4 Methods of drying, types of drying and various equipments used for drying in food industry. 3.5 Dehydration definition, importance of dehydration, application of dehydration and various equipments used for dehydration. 3.6 Concentration definition, working principle, methods and application in food industry.	3.1. Knowing about importance and limitations of drying and dehydration in food industry.

SW-3 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT322.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding the Preservation of food by irradiation. **SO4.2** Understanding the various types of irradiation. **SO4.3** Understanding the Preservation of food by acidulants. **SO4.4** Understanding the preservation of food by antioxidants. **SO4.**5 Understanding the Preservation of food by fermentation.	4.1. To study about preservation of food by acidulants. 4.2. To study about preservation of food by fermentation.	**Unit 4** 4.1 Irradiation definition, working principle and equipments used for irradiation. 4.2 Methods of irradiation. 4.3 Preservatives definition, chemical preservatives and classification of preservatives. 4.4 Permissible limit of class 2 preservatives, use of antioxidants and types of antioxidants. 4.5 Use of mould inhibitors and types of mould inhibitors, use of antibodies, Use of acidulants and types of acidulants. 4.6 Fermentation definition, working principle, methods and equipments used for fermentation.	4.1. Preparation of process flow diagram of vinegar.

SW-4 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT322.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand the Non-thermal preservation processes. **SO5.2** Knowledge about Pulsed electric field and pulsed intense light. **SO5.3** Understand about ohmic and infrared heating. **SO5.4** Understand about high pressure processing. **SO5.**5 Quality tests and shelf-life of preserved foods.	5.1. Study on effect of high pressure on microbe. 5.2. Study on effect of pulse electric field on food.	5.1 Principles and equipments of Pulsed electric field and pulsed 5.2 intense light. Principles and equipments of ultrasound and 5.3 Dielectric heating. 5.4 Principles and equipments of ohmic heating. 5.5 Infrared heating. 5.6 Principles and equipments of high pressure processing and microwave processing.	5.1 Application of various non-thermal processing methods in food industry.

SW-5 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+ SW+SL)
54FT322.1: Understand the knowledge of sources, types and perishability of food products.	6	4	1	1	12
54FT322.2: Acquired the knowledge of preservation of food by application heat.	6	4	1	1	12
54FT322.3: Acquired the knowledge of preservation of food by low temperature.	6	4	1	1	12
54FT322.4: Understand the knowledge of preservation of food by irradiation, chemicals and fermentation.	6	4	1	1	12
54FT322.5: Apply the knowledge of various non-thermal preservation methods of food.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Sources, types and perishability of foods, causes and types of food spoilage.	03	02	01	06
CO-2	Preservation of food by heat treatment.	03	05	03	11
CO-3	Preservation of food by use of low temperature, drying, dehydration and concentration.	03	05	03	11
CO-4	Preservation of food by irradiation, chemicals and fermentation.	03	05	03	11
CO-5	Non-thermal preservation of food: Principles, equipment.	03	03	05	11
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Fundamental of Food Processing will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Processing Technology: Principles and Practice	P. Fellows	CRC Press, Boca Raton, FL, USA	2nd Ed., 2000
2	Preservation of Fruits and Vegetables	Girdhari Lal, G.S. Siddappa and G.L. Tandon	ICAR, New Delhi	1959
3	Advances in Thermal and Non-Thermal Food Preservation	Gaurav Tewari and Vijay K. Juneja	Blackwell Publishing, Ames, Iowa, USA	2007
4	Handbook of Food Preservation	M. Shafiur Rahman	CRC Press, Boca Raton, FL, USA	2nd Ed., 2007
5	Food Processing Technology: Principles and Practice	P. Fellows	CRC Press, Boca Raton, FL, USA	2nd Ed., 2000

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AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54FT322

Course Title: Fundamental of Food Processing

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Sources, types and perishability of foods, causes and types of food spoilage.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Preservation of food by	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

heat treatment.																
CO3: Preservation of food by use of low temperature, drying, dehydration and concentration.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Preservation of food by irradiation, chemicals and fermentation.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Non-thermal preservation of food: Principles, equipment.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Lab. Instruction(LI)	Classroom Instruction(CI)	Self Learning
PO 8 and,10 PSO 1,2, 3, 4	CO1: Sources, types and perishability of foods, causes and types of food spoilage.	**SOs 1-5**	4	**Unit-I** Sources,types and perishability of foods; Causes and types of food spoilage; Scope and benefit of food preservation; Methods of food preservation; Preservation by salt and sugar: Principle, method and effect on food quality.	**As mentioned in page number 3 to 7**
PO 2,7 and 12 PSO 1,2, 3, 4	CO2: Preservation of food by heat treatment.	**SOs 1-5**	4	**Unit-II** Preservation by heat treatment: Principle and equipment for blanching, canning, pasteurization, sterilization.	
PO 2 and 5 PSO 1,2, 3, 4	CO3: Preservation of food by use of low temperature, drying, dehydration and concentration.	**SOs 1-5**	4	**Unit-III** Preservation by use of low temperature: Principle, methods, equipment; Preservation by drying, dehydration and concentration: Principle, methods, equipment;	
PO 2, 5, 7, 11 and 12 PSO 1,2, 3, 4	CO4: Preservation of food by irradiation, chemicals and fermentation.	**SOs 1-5**	4	**Unit-IV** Preservation by irradiation: Principle, methods, equipment; Preservation by chemicals-antioxidants, mould inhibitors, antibodies, acidulants, etc. Preservation by fermentation: Principles, methods, equipment.	
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	CO5: Non-thermal preservation of food: Principles, equipment.	**SOs 1-5**	4	**Unit-V** Non-thermal preservation processes: Principles, equipment – Pulsed electric field and pulsed intense light, ultrasound, dielectric heating, ohmic and infrared heating, high pressure processing, microwave processing, etc.; Quality tests and shelf-life of preserved foods.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54FT323
Course Title :	Processing Technology of Milk & Milk Products
Pre- requisite:	Student should have basic knowledge of processing of milk and milk products, ensuring the safety, quality, and consistency of the final products. Complying with industry standards and regulations is also critical to meet consumer expectations and legal requirements.
Rationale:	The students studying Processing Technology of Milk & Milk Products should possess foundational understanding about production and processing scenario of milk and milk products, various techniques and methods to transform raw milk into a variety of products and dairy project planning.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT323.1	Understand the knowledge of production and processing scenario of milk, composition of milk, role of cooperatives and food technologists.
54FT323.2	Acquired the knowledge of planning and layout of dairy plant.
54FT323.3	Understand the knowledge of basic concept and theory of heat exchanger.
54FT323.4	Understand the knowledge of various thermal processing methods, homogenization, centrifugation and lactic acid fermentation.
54FT323.5	Apply the knowledge of types of milk, coagulated milk products, spray drying and packaging of milk and milk products.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT323	Processing Technology of Milk & Milk Products	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA1	SA2			
PCFT	54FT323	Processing Technology of Milk & Milk Products	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course

Outcomes (COs) upon the course's conclusion.
54FT323.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand technical terms and composition of milk. **SO1.2** Understand about production and processing scenario of milk. **SO1.3** Role of Cooperatives in Dairy Industry. **SO1.4** Importance and need of Milk Processing industry. **SO1.**5 Role of Food Technologist in Dairy Industry.	1.1. To Study on basics of reception of milk. 1.2. To Study on platform tests in milk.	1.1 Introduction, definition, technical terms and milk composition, factors affecting the milk composition. 1.2 Status of Milk Production and Dairy Industry in India and world. 1.3 Definition of cooperative, types of cooperative. 1.4 Role of cooperative in dairy industry. 1.5 Classification of dairy industry, scope of dairy industry 1.6. importance and need of dairy industry.	1.1. Introduction to various dairy products.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Notes –

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT323.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 To Understand Plan and Layout of Dairy Plant. **SO2.2** To Understand about Dairy Project Planning. **SO2.3** To understand Various Section and divisions of Dairy Plant. **SO2.4** To understand the Flow diagram of Milk Processing. **SO2.**5 To learn technical specification of various Machinery and Equipments used in Dairy Plant.	2.1. To study about site selection and site location. 2.2. To study on Dairy Plant Layout and different sections with concern equipment and machinery.	2.1 Planning and layout of dairy plant. 2.2 Selection of site location of site. 2.3 Dairy project planning, estimation of capacity of dairy plant, market feasibility study. 2.4 Building construction of dairy plant. 2.5 Allocation of various sections and divisions of dairy plant and flow diagram of Milk Processing. 2.6 Introduction, working principle, technical specification of various Machinery and Equipments used in Dairy Plant.	2.1. Knowledge about the classification of dairy industry.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Note:
54FT323.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 To Understand Thermal Processing in Milk Plant. **SO3.2** To Understand about Basic concept and theory of Heat Exchangers. **SO3.3** To understand application of heat exchanger. **SO3.4** To understand the Types of Heat exchanger. **SO3.**5 To learn about the basic difference between evaporation and vaporization.	3.1. To study about the various components of LTLT pasteurizer. 3.2. To study about the various components of HTST pasteurizer.	3.1 Introduction, working principle and types of thermal processing of milk. 3.2 Mode of heat transfer. 3.3 Concept of heat exchanger, theory of heat exchanger. 3.4 Classification of heat exchanger (parallel flow type, counter flow type and cross flow type). 3.5 Numerical based on Parallel and counter flow heat exchanger to determine the cooler surface area and effectiveness of heat exchanger. 3.6 Evaporation and vaporization process.	3.1. Need and importance of heat exchanger in milk processing industry.

SW-3 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT323.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understanding the Pasteurization and Sterilization of milk. **SO4.2** Understanding the technical aspect of Homogenization. **SO4.3** Understanding the Centrifugation and Concentration process in Milk. **SO4.4** Understanding the General aspect of membrane process. **SO4.**5 Understanding the Lactic fermentation of milk.	4.1. Study and experimentation with the Lacto Scan. 4.2. Determination of Fat in Milk.	4.1 Introduction need, definition, and importance of Milk Pasteurization and Sterilization. 4.2 Method of Pasteurization- Batch and Continuous method. 4.3 HTST Process Flow Diagram and Component of HTST Pasteurizer. 4.4 Technical terms used in Pasteurization. Technical Aspect of Sterilization. 4.5 Introduction, definition and technical aspect of Homogenization. 4.6 Centrifugation and Concentration process in Milk processing, Factors affecting fat globules size, General aspect of membrane process and Lactic fermentation.	4.1. Importance of time and temperature combination in milk processing industry. Basic difference between the various thermal treatment methods.

SW-4 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Note:
54FT323.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand about the production flow diagram of pasteurized and sterilized milk. **SO5.2** Knowledge about Coagulated milk products. **SO5.3** Understand about the dried milk product. **SO5.4** Understand about the technical and quality aspects of various milk products. **SO5.**5 Technical aspect of storage and packaging of Milk and Milk Products.	5.1. Detection of detergent in Milk. 5.2. Quantitative Estimation of Urea in Milk.	5.1. Production flow diagram of different milk products. 5.2. Technical and quality aspects, i.e. Pasteurized and Sterilized Milk. 5.3. Cream, Butter and Cheese. 5.4. Concentrated Milk, Milk Powder. 5.5 Technical aspect of storage 5.6. Packaging of Milk and Milk Products	5.1. Description of cream as per Codex Alimentarius Commission.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project: Case study about status of cereal processing industry in India
c. Other Activities (Specify):

Types of various minor spices based processed products.

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+ SW+SL)
54FT323.1: Understand the knowledge of production and processing scenario of Milk, composition of milk, role of cooperatives and food technologists.	6	4	1	1	12
54FT323.2: Acquired the knowledge of planning and layout of dairy plant.	6	4	1	1	12
54FT323.3: Understand the knowledge of basic concept and theory of heat exchanger.	6	4	1	1	12
54FT323.4: Understand the knowledge of various thermal processing methods, homogenization, centrifugation and lactic acid fermentation.	6	4	1	1	12
54FT323.5: Apply the knowledge of types of milk, coagulated milk products, spray drying and packaging of milk and milk products.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Production and processing scenario of Milk, composition of milk, role of cooperatives and food technologists.	03	02	01	06
CO-2	Planning and layout of dairy plant.	03	05	03	11
CO-3	Basic concept and theory of heat exchanger.	03	05	03	11
CO-4	Various thermal processing methods of milk, homogenization, centrifugation and lactic acid fermentation.	03	05	03	11
CO-5	Types of milk, coagulated milk products, spray drying and packaging of milk and milk products.	03	03	05	11
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing Technology of Milk and Milk Products will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Outlines of Dairy Technology	Sukmar De	Oxford University Press, New Delhi	1999
2	Dairy Plant Engineering and Management	Tufail Ahmed	CBS Publishers and Distributors, New Delhi, 2001	2001
3	Modern Diary Technology Vol. 1 "Advances in Milk Processing	Robinson R.K	Elsevier Applied Science Publishers, London	1996
4	Dairy Science & Technology	Pieter Walsta,Jan T.M. Wouters and Tom J.Geurts	CRC Press Taylor and Francis Group, UK	Dairy Science & Technology

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT323
Course Title: Processing Technology of Milk and Milk Products

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Production and processing scenario of Milk, composition of milk, role of cooperatives and food technologists.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Planning and layout of	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

dairy plant.																
CO3: Basic concept and theory of heat exchanger.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Various thermal processing methods of milk, homogenization, centrifugation and lactic acid fermentation.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Types of milk, coagulated milk products, spray drying and packaging of milk and milk products.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 8 and,10 PSO 1,2, 3, 4	CO1: Production and processing scenario of Milk, composition of milk, role of cooperatives and food technologists.	SOs 1-5	LI 1-2	Status of Milk Production and Dairy Industry in india and world.Role of Cooperatives in Dairy Industry, Importance and need of Milk Processing industry. Role of Food Technologist in Dairy Industry. Introduction to various Dairy Products.	As mentioned in page number 3 to 7
PO 2,7 and 12 PSO 1,2, 3, 4	CO2: Planning and layout of dairy plant.	SOs 1-5	LI 1-2	Dairy Project Planning, Various Section and divisions of Dairy Plant, Flow diagram of Milk Processing. Introduction, working principle, technical specification of various Machinery and Equipments used in Dairy Plant.	
PO 2 and 5 PSO 1,2, 3, 4	CO3: Basic concept and theory of heat exchanger.	SOs 1-5	LI 1-2	Basic concept and theory of Heat Exchangers, Types of Heat exchanger. Evaporation, Numerical based on Parallel and counter flow heat exchanger to determine the cooler surface area and effectiveness of heat exchanger.	
PO 2, 5, 7, 11 and 12 PSO 1,2, 3, 4	CO4: Various thermal processing methods of milk, homogenization, centrifugation and lactic acid fermentation.	SOs 1-5	LI 1-2	Introduction need, definition, and importance of Milk Pasteurization and Sterlization,Method of Pasteurization-Batch and Continuous method. HTST,Process Flow Diagram and Component of HTST Pasteurizer, Technical terms used in Pasteurization. Technical Aspect of Sterilization. Introduction, definition and technical aspect of Homogenization, Centrifugation and Concentration process in Milk processing, Factors affecting fat globules size, General aspect of membrane process. Lactic fermentation.	
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	CO5: Types of milk, coagulated milk products, spray drying and packaging of milk and milk products.	SOs 1-5	LI 1-2	Unit-V Production flow diagram of different milk products, their technical and quality aspects, i.e. Pasteurized and Sterilized Milk, Cream, Butter, Concentrated Milk, Milk Powder, Cheese. Technical aspect of storage and packaging of Milk and Milk Products	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54BT325
Course Title :	Industrial Microbiology
Pre- requisite:	Students should have basic knowledge of various metabolisms in Lower Botany.
Rationale:	Students will acquire knowledge regarding the distinct cell organelles found in microorganisms and their specific functions. Students will also explore the proliferation and regulation of microorganisms, along with various bacteriological methodologies employed in the field of microbiology. Students will acquire knowledge about biomolecules through the examination of their structures and classifications.

Course Outcomes (CO):

Course Code	Course Outcomes
54BT325.1	Defines the methods of Screening and Preservation of Microbes.
54BT325.2	To enrich the methods of industrial sterilization.
54BT325.3	Describe the Components, working principle and applications of Fermentor.
54BT325.4	To acquire knowledge about Probiotics and its applications.
54BT325.5	To acquire knowledge about Downstream Processing.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54BT325	Industrial Microbiology	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA1	SA2			
PCFT	54BT325	Industrial Microbiology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BT325.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand Evolution of Industrial Microbiology SO1.2 Understand Cellular Metabolites SO1.3 Understanding the Screening of microorganisms SO1.4 Understanding the Preservation of microorganisms SO1.5 Listing the Microbial industries	1.1 Isolation and screening of citric acid/ amylase/ protease /antibiotic producing microbes 1.2 Production of citric acid/Lactic acid/ Acetic acid	1.1History of industrial microbiology 1.2. Primary and secondary metabolites produced by the microorganisms 1.3. Screening of microorganisms 1.4. Preservation of microorganisms 1.5. Organizations involved in microbiological work 1.6. Importance of Microbes at industry	1.1. Knowledge about doubling time of Microbes

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BT325.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand Fermentation media SO2.2 Understand TDT SO2.3 Understanding detail about Sterilization SO2.4 Understanding basic approach of sterilization SO2.5 Classify the sterilization.	2.1. Purification of citric acid/Lactic acid/ Acetic acid and Estimation of citric acid/Lactic acid/ Acetic acid 2.2. Standardization of physical factors for higher yields of citric acid	2.1. Fermentation media, Industrial sterilization 2.2. Definition, thermal death time 2.3. Media heat sterilization, advantages of continuous sterilization 2.4. Design of sterilization 2.5. Deterministic and probabilistic approach in designing of sterilizing equipments 2.6. Sterilization charts	2.1. Knowledge of role of sterilization in our Food.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BT325.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand Components of fermentor SO3.2 Understand Parts and working of Fermentor SO3.3 Understanding types of Fermentor SO3.4 Understanding types of fermentation SO3.5 Understanding Potential Metabolites	3.1. Isolation, identification of cultures producing bio-colors 3.2. Production, purification and estimation of beer/ ethanol	3.1. Fermentor: Components of a fermentor 3.2. Parts of fermentors, peripheral parts and accessories 3.3. Additional accessories and peripherals 3.4. Types of fermentors 3.5. Types of fermentations 3.6. Industrially important secondary metabolites; and microorganisms involved	3.1. Knowledge about requirements of Fermentation Process

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BT325.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understand Probiotics and its types SO4.2 Understand organism involved in Probiotics SO4.3 Understanding Beneficial effects of Probiotics SO4.4 Understanding Microbial enzyme production SO4.5 Understanding Downstream processing	4.1. Production, purification and assay of fungal amylases/proteases/Lipase 4.2. Production and assay of nisin from lactic acid bacteria	4.1. Probiotics: Importance, role in fermented foods 4.2. Organisms involved, beneficial effects; 4.3. Bacteriocins 4.4. Nisin 4.5. Production of microbial enzymes 4.6. Downstream processing	4.1 Detailed information on Mode of action for Probiotics.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54BT325.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Cell disruption methods SO5.2 Understand Mechanical disruption methods SO5.3 Understanding Non-mechanical disruption methods SO5.4 Understanding methods of Product recovery SO5.5 Understanding Product recovery	5.1. Single cell protein production 5.2. Starter activity of Baker's yeast Mushroom production .	5.1. Cell disruption methods 5.2. Mechanical disruption methods 5.3. Non-mechanical disruption methods 5.4. Extraction 5.5. Purification; Concentration; 5.6. Product recovery	5.1. Knowledge about various techniques for agitation

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL +SW+SL)
54BT325.1: Defines the methods of Screening and Preservation of Microbes.	6	4	1	1	8
54BT325.1: To enrich the methods of industrial sterilization.	6	4	1	1	8
54BT325.3: Describe the Components, working principle and applications of Fermentor.	6	4	1	1	8
54BT325.4: To acquire knowledge about Probiotics and its applications.	6	4	1	1	8
54BT325.4: To acquire knowledge about Downstream Processing.	6	4	1	1	8
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Methods of Screening and Preservation of Microbes.	5	3	2	10
CO-2	Methods of industrial sterilization.	2	3	5	10
CO-3	Components, working principle and applications of Fermentor.	2	3	5	10
CO-4	Probiotics and its applications.	2	3	5	10
CO-5	Downstream Processing.	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Industrial Microbiology will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Modern Industrial Microbiology and Biotechnology	Nduka Okafor	Science Publishers, Enfield, New Hampshire, USA	2007
2	Brewing Science and Practice	Dennis E. Briggs, Chris A. Boulton, Peter A, Brookes and Roger Stevens	Woodhead Publishing Ltd. Cambridge, England	2004
3	Prescott & Dunn's Industrial Microbiology	G. Reed	AVI Publishers, Connecticut, USA	2004., 4th Ed..

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AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54BT326

Course Title: Industrial Microbiology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Methods of Screening and Preservation of Microbes.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Methods of industrial	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

sterilization.																
CO3: Components, working principle and applications of Fermentor.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Probiotics and its applications.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Downstream Processing.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 1 to 12 and PSO 1 to 4	CO1: Methods of Screening and Preservation of Microbes.	**SOs 1-5**	**LI 1.1-1.2**	History of industrial microbiology; Primary and secondary metabolites produced by the microorganisms; Screening of microorganisms; Preservation of microorganisms; Organizations involved in microbiological work;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Methods of industrial sterilization.	**SOs 1-5**	**LI 2.1-2.2**	Fermentation media, Industrial sterilization; Definition, thermal death time, media heat sterilization, advantages of continuous sterilization, design of sterilization, deterministic and probabilistic approach in designing of sterilizing equipments, sterilization charts;	
PO 1 to 12 and PSO 1 to 4	CO3: Components, working principle and applications of Fermentor.	**SOs 1-5**	**LI 3.1-3.2**	Fermentor: Components of a fermentor, parts of fermentors, peripheral parts and accessories, additional accessories and peripherals. Types of fermentors: Types of fermentations; Industrially important secondary metabolites; and microorganisms involved;	
PO 1 to 12 and PSO 1 to 4	CO4: Probiotics and its applications.	**SOs 1-5**	**LI 4.1-4.2**	Probiotics: Importance, role in fermented foods, organisms involved, beneficial effects; Bacteriocins; Nisin: Production of microbial enzymes; Downstream processing;	
PO 1 to 12 and PSO 1 to 4	CO5: Downstream Processing.	**SOs 1-5**	**LI 5.1-5.2**	Cell disruption methods: Mechanical disruption methods and non-mechanical disruption methods; Extraction; Purification; Concentration; Product recovery	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54FT324
Course Title :	Processing Technology of Cereals
Pre- requisite:	Students should have basic knowledge of Post harvest operations of agro processing
Rationale:	The students studying Food Technology should possess foundational understanding about production and processing scenario of different cereal crops and method of value added product development

Course Outcomes (CO):

Course Code	Course Outcomes
54FT324.1	Understanding about Present status and future prospects of cereals and millets; Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value;
54FT324.2	Acquire the knowledge about paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods;
54FT324.3	Acquire the knowledge about Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches
54FT324.4	To acquire the knowledge about processing of Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets;
54FT324.5	Learning about Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT324	Processing Technology of cereals	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT324	Processing Technology of cereals	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT324.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understanding about current status of production and processing of cereals in India SO1.2 Understanding about basic structure of different cereal grain SO1.3 Understanding about production status and processing of major millets SO1.4 Understanding about production status and processing of minor millets SO1.5 Understanding about nutritional composition of different cereal grain	1.1 -Study on Morphological characteristics of cereals 1.2-Study on Physical properties of cereals	1.1. Present status and future prospects of cereals and millets 1.2. Morphology, physico-chemical properties of cereals, 1.3. Major millets 1.4. Minor millets 1.5. Chemical composition 1.6. Nutritive value;	1.1. Production and processing status of cereals in India

SW-1 Suggested Sessional Work (SW):

a. Assignments: Detailed description about Plant and machinery required for cereal industry

b. Mini Project:

c. Other Activities (Specify):

Notes -

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT324.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understanding about Basics of Paddy Processing technology and different milling methods SO2.2 Improvement of technical skill of students for milling operation SO2.3 Analytical skill development during industrial milling operation SO2.4 Knowledge about quality analysis of milled rice SO2.5 Knowledge about parboiling and gelatinization of starch	2.1. Experiment on Parboiling of paddy 2.2 Assessment of Cooking quality of rice	2.1. Paddy processing and rice milling: 2.2. Conventional milling 2.3. Modern milling, milling operations, 2.4. Milling machines, milling efficiency; 2.5. Quality characteristics influencing final milled product; 2.6. Parboiling; Rice bran stabilization and its methods;	2.1 Study about different milling method of cereal grain

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project: Case study about Historical overview of traditional and modern rice milling methods in India

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT324.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understanding about wheat milling operation and machinery SO3.2 Knowledge about different quality parameter of wheat quality SO3.3 Improvement in operational skill of the students for corn milling plant SO3.4 Knowledge about processing method of starch and glutin separation of cereal grain SO3.5 Understanding about milling fractions and modified starch	3.1. Study on Milling of rice 3.2. Experiment on Conditioning and milling of wheat;	3.1. Wheat milling: Break system, 3.2. Purification system and reduction system; 3.3. Extraction rate and its effect on flour composition 3.4. Quality characteristics of flour and their suitability for baking; 3.5. Corn milling: Dry and wet milling of corn, starch 3.6. Gluten separation, milling fractions and modified starches;	3.1. Study about Wheat milling Method

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project: Case study about wheat and corn milling industry in india
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT324.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understanding about process flow of malting and oat processing SO4.2 Understanding about sorghum milling ,malting and pearling methods SO4.3 Knowledge about processing methods of millets SO4.4 Understanding about Secondary and tertiary products processing of cereals and millets; SO4.5 Improvement of operational knowledge for cereal by products processing in manufacturing plant	4.1. Production of sorghum flakes; 4.2. Production of popcorns,	4.1. Barley: Malting and milling 4.2. Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; 4.3. Millets (Pearl millets, finger millets): 4.4. Processing of millets for food uses 4.5. Secondary and tertiary products processing of cereals and millets; 4.6. By-products processing of cereals and millets;	4.1. Study about Plant and machinery required for millet processing

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT324.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understanding about Processing of infant foods from cereals and millets; SO5.2 Understanding about overview and technical aspect of breakfast cereal foods SO5.3 Understanding about overview and processing aspect of Flaked cereal foods SO5.4 Understanding about overview and processing aspect of Puffed cereal food , expanded cereal products, SO5.5 Understanding about overview and processing aspect of extruded and shredded cereal food products	5.1. Study and experiment on flaked rice, 5.2. Study and experiment on puffed rice	5.1. Processing of infant foods from cereals and millets; 5.2. Breakfast cereal foods: 5.3. Flaked cereal foods 5.4. Puffed cereal food , 5.5. Expanded cereal products, 5.6. Extruded and shredded cereal food products	5.1. Study about plant and machinery required for cereal industry

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project: Case study about status of cereal processing industry in India

c. Other Activities (Specify):

Types of various minor spices based processed products.

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+SW+SL)
54FT324.1 Understanding about Present status and future prospects of cereals and millets; Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value;	6	4	1	1	8
54FT324.2 Acquire the knowledge about paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods.	6	4	1	1	8
54FT324.3 Acquire the knowledge about Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches.	6	4	1	1	8
54FT324.4 To acquire the knowledge about processing of Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets.	6	4	1	1	8
54FT324.5 Learning about Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.	6	4	1	1	8
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Present status and future prospects of cereals and millets	5	3	2	10
CO-2	Paddy processing and rice milling	2	3	5	10
CO-3	Wheat milling	2	3	5	10
CO-4	Barley: Malting and milling	2	3	5	10
CO-5	Processing of infant foods from cereals and millets	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing Technology of Cereals will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:
Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Post Harvest Technology and Food Process Engineering.	Amalendu Chakraverty and R. Paul Singh.	CRC Press, Boca Raton, FL, USA.	2014
2	Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices.	Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy.	Marcel Dekker, Inc., NY, USA.	2003
3	Cereal and Cereal Products: Technology and Chemistry.	David A.V. Dendy and Bogdan J. Dobraszczyk.	Springer-Verlag, US.	2001.
4	The Chemistry and Technology of Cereals as Food and Feed,	Samuel A. Matz.	Springer Science + Business Media, NY, USA.	1991. 2nd Ed.

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT324
Course Title: Processing Technology of Cereals

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Understanding about Present status and future prospects of cereals and millets; Morphology,physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3

CO2: Acquire the knowledge about paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods.	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO3: Acquire the knowledge about Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: To acquire the knowledge about processing of Barley: Malting and milling; Oat/Rye: Processing,	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3

milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets;																
CO5::Learning about Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 1,6 and,10 PSO 1,2, 3, 4	Understanding about Present status and future prospects of cereals and millets; Morphology,physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value.	**SOs 1-5**	2	Present status and future prospects of cereals and millets; Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value.	**As mentioned in page number 3 to 7**
PO 1.2,8 and 12 PSO 1,2, 3, 4	Acquire the knowledge about paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods.	**SOs 1-5**	2	Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods.	
PO 1,2, 6 and 5 PSO 1,2, 3, 4	Acquire the knowledge about Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches.	**SOs 1-5**	2	Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches.	
PO 1, 3, 6, 7 and 11 PSO 1,2, 3, 4	To acquire the knowledge about processing of Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets;	**SOs 1-5**	2	Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets;	
PO 1, 3, 6, 7 and 11 PSO 1,2, 3, 4	Learning about Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.	**SOs 1-5**	2	Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54ME327
Course Title :	Heat and Mass Transfer in Food Processing
Pre- requisite:	Student should have basic knowledge of Physics and Mathematics.
Rationale:	This course follows a unified approach to introduce the physical origins and rate equations of heat transfer. The principal topics covered include identification of the driving forces for heat transfer. The students will learn how to identify the fundamental heat transfer and mass transfer mechanisms.

Course Outcomes (CO):

Course Code	Course Outcomes
54ME327.1	Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.
54ME327.2	Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.
54ME327.3	Discuss various correlations of natural and forced convection, understand various correlations of natural and forced convection
54ME327.4	Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling and condensation regimes.
54ME327.5	Students will analyze mass transport phenomena, design separation processes, and apply principles to solve real-world problems in diverse industries.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54ME327	Heat and Mass Transfer in Food Processing	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2+ ESPA+ESE)
			SA1	SA2			
PCFT	54ME327	Heat and Mass Transfer in Food Processing	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course

Outcomes (COs) upon the course's conclusion.

54ME327.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 Ability to understand the concept of heat and mass transfer, explain the different mode of heat transfer and their applications **SO1.2**Understand and Solve heat transfer by conduction in solids for steady state conditions. **SO1.3**The students will be able to Analyze examples of heat conduction in everyday objects and systems.	**1.1** Introduction to Heat and Mass Transfer Lab. **1.2** Study of thermal conductivity of insulating powder. .	1.1 Introduction to heat transfer 1.2 General concepts of heat transfer by conduction, convection and radiation 1.3 Fourier's Law and Electrical analogy of thermal systems. 1.4 General heat conduction equation in three dimensions (3D) in cartesian coordinates. 1.5 One dimensional (1D) conduction without heat generation: through plain walls. 1.6 Problems based on 1D conduction without heat generation in plane wall and composite wall .	1.1. Numerical problem solving on composite slabs using electrical analogy and Fourier's Law.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Notes -

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME327.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 The students will be able to understand the concept of lumped capacity analysis. **SO2.2**The students will be able to understand the concept and applications of fins.	2.1 Study of composite wall apparatus. 2.2 Calculate heat transfer rate through composite wall apparatus.	2.1 Introduction: Unsteady state Heat Transfer conduction. 2.2 Lumped capacity method and its Validity. Blot no.& Fourier No. 2.3 Equation of Heat conduction and temperature distribution through fins. 2.4 Fin effectiveness and fin efficiency. 2.5 Numerical problem based on effectiveness and efficiency of fin. 2.6 Problems to find temperature distribution and heat transfer rate through fin.	2.1. Numerical problems based on design of fins.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME327.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 The students will be able to understand the mechanisms of forced and natural convection. **SO3.2** Understanding basic definitions. **SO3.3** Evaluate the Radiative heat exchange. **SO3.4** To determine the Emissive power	3.1 Study of heat transfer in forced convection. 3.2 Calculate heat transfer rate through forced convection.	3.1 Physical Mechanism of Forced and Free convection 3.2 Introduction to Dimensional analysis 3.3 Methods of Dimensional Analysis. 3.4 Black body radiation: Absorptive, reflectivity & Transmissivity. 3.5 Kirchhoff's laws, Shape, factor, Algebra, salient features. 3.6 Numerical problems on shape factor.	3.1.Understanding Dimensionless numbers.

SW-3 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project: Case study about wheat and corn milling industry in india
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME327.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 To understand the regimes of boiling. **SO4.2** To understands the regimes of condensation. **SO4.3**. Analyzing& Solving Problems on heat exchangers.	4.1 Study of parallel and counter flow heat exchanger. 4.2 Calculate heat transfer rate through heat exchanger.	4.1 Introduction to boiling and condensation heat transfer. 4.2 Heat exchanger and its classification. 4.3 LMTD analysis of parallel and counter flow heat exchangers. 4.4 Effectiveness and efficiency of heat exchangers. 4.5 Numerical problems on LMTD approach of heat exchangers. 4.6 Numerical problems on efficiency and effectiveness of heat exchanger.	4.1. Analyze the cross-flow heat exchanger.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54ME327.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Define and explain the fundamental principles of mass transfer. **SO5.2** Relate mass transfer	5.1. To apply Fick's law of diffusion. 5.2. Study of Stefan Boltzmann apparatus.	5.1 Introduction to mass transfer. 5.2 steady state diffusion of gases and liquids through solids. 5.3 Fick's law of diffusion. 5.4 application in dairy 5.5. Applications in food industry. 5.6. Principles to real-world applications in chemical engineering and related fields.	5.1 Explain the modes of mass transfer.

SW-5 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project: Case study about status of cereal processing industry in India
c. Other Activities (Specify):
Types of various minor spices based processed products.
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	**Class Lecture (CL)**	**Lab Instructions (LI)**	**Sessional Work (SW)**	**Self Learning (SL)**	**Total Hours(CL+SW+SL)**
54ME327.1 Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.	6	4	1	1	8
54ME327.2 Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.	6	4	1	1	8
54ME327.3 Discuss various correlations of natural and forced convection, understand various correlations of natural and forced convection	6	4	1	1	8
54ME327.4 Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling and condensation regimes.	6	4	1	1	8
54ME327.5 Students will analyze mass transport phenomena, design separation processes, and apply principles to solve real-world problems in diverse industries.	6	4	1	1	8
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Heat Transfer By Conduction	5	3	2	10
CO-2	Transient Heat Conduction and Fins	2	3	5	10
CO-3	Forced and Natural convection. Thermal Radiation	2	3	5	10
CO-4	Two Phase Heat Transfer and Heat Exchangers.	2	3	5	10
CO-5	Mass Transfer	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Heat and Mass transfer will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Heat Transfer	Holman, J. P.	McGraw Hill	9th Edition, 2004
2	Heat Transfer - A Practical Approach	Cengel, Y.A.	McGraw-Hill	1998
3	Fundamentals of Heat and Mass Transfer	Incropera, F.P. and Dewitt, D.P.	John Wiley	5th Edition, 2002

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AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54ME327

Course Title: Heat and Mass Transfer in Food Processing

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2 Explain the phenomenon of transient heat transfer in one dimension. Define,	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

classify and analyze the fins.																
CO3 Discuss various correlations of natural and forced convection, understand various correlations of natural and forced convection	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4 Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling and condensation regimes.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5 Students will analyze mass transport phenomena, design separation processes, and apply principles to solve real-world problems in diverse industries.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO1 Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.	SO 1-3	1-3	Basic heat transfer processes, heat transfer coefficients, properties related to heat transfer; One-dimensional steady state conduction: Theory of heat conduction, Fourier's law and its derivation, Concept of electrical analogy and its application for thermal circuits, heat transfer through composite walls and insulated pipelines; One-dimensional steady state heat conduction with heat generation: Heat flow through slab, hollow sphere and cylinder with linear heat transfer, uniform/non-uniform heat generation, development of equations of temperature distribution with different boundary conditions	As mentioned in page number 3 to 7
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2 Explain the phenomenon of transient heat transfer in one dimension. Define, classify and analyze the fins.	SO 1-2	1-5	Steady-state heat conduction with heat dissipation to environment: Introduction to extended surfaces (fins) of uniform area of cross-section and with Equation of temperature distribution with different boundary conditions; Effectiveness and efficiency of the fins; Introduction to unsteady state heat conduction: System with negligible internal resistance and in various geometries;	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO3 Discuss various correlations of natural and forced convection, understand various correlations of natural and forced convection	SO 1-4	1-4	Convection: Forced and free convection, use of dimensional analysis for correlating variables affecting convection heat transfer; Concept of Nusselt number, Prandtl number, Reynolds number, Grashoff number, some important empirical relations used for determination of heat transfer coefficient; Heat transfer to flowing fluids; Radiation: Heat radiation, emissivity, absorptivity, transmissivity, radiation through black and grey surfaces, determination of shape factors;	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO4 Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling and condensation regimes.	SO 1-3	1-2	Introduction to condensing and boiling heat transfer: Film- and drop-wise condensation, effect of non-condensable gases, boiling heat transfer; Heat Exchangers: General discussion, fouling factors, jacketed kettles, LMTD, parallel and counter flow heat exchangers, shell and tube and plate heat exchangers, heat exchanger design; Application of different types of heat exchangers in dairy and food industry;	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO5 Students will analyze mass transport phenomena, design separation processes, and apply principles to solve real-world problems in diverse industries.	SO 1-2	5.1	Mass transfer: Fick's law of diffusion, steady state diffusion of gases and liquids through solids, equimolal diffusion, isothermal evaporation of water into air, mass transfer coefficient, application in dairy and food industry.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54FT326
Course Title :	Food Chemistry of Micronutrients
Pre- requisite:	A solid understanding of basic chemistry of micro nutritional composition of food including Flavor, color, vitamins and minerals , is essential as it forms the basis of food chemistry
Rationale:	Studying the food chemistry of micronutrients is crucial for understanding their vital role in human health. Micronutrients, including vitamins and minerals, are essential for metabolic functions, immune support, and overall well-being. This knowledge is key to preventing deficiencies, optimizing nutrient absorption, and developing fortified foods. The study also contributes to personalized nutrition and the prevention of chronic diseases, making it an indispensable aspect of promoting optimal health

Course Outcomes (CO):

Course Code	Course Outcomes
54FT326.1	Micronutrient Identification: Students will be able to identify and classify essential micronutrients, such as vitamins and minerals commonly found in foods.
54FT326.2	Chemical Structure and Properties: Understand the chemical structures, properties, and reactivity of different micronutrients, including their molecular compositions and functional groups
54FT326.3	Micronutrient Bioavailability: Comprehend the factors affecting the bioavailability of micronutrients, including interactions with other nutrients, food matrices, and factors like pH
54FT326.4	Micronutrient Stability: Evaluate the impact of environmental factors, such as light, temperature, and oxygen, on the stability and degradation of micronutrients in food products
54FT326.5	Nutrient Interactions: Analyze how micronutrients interact with one another and with macronutrients in food, and the consequences of these interactions for overall nutrition.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT326	Food Chemistry of Micronutrients	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 326	Food Chemistry of Micronutrients	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT326.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1: To explore Introduction and chemical properties of Micronutrients **SO1.2:** Components of Flavor **SO1.3:** To understand Taste perception and role of aroma **SO1.4:** To explore the Mouthfeel and Flavor Perception and Psychology **SO1.5.** To gain knowledge on Flavor Development and Cooking	1.1. Preparation of mineral solution by using ash and tri-acid method (dry and wet oxidations); 1.2 Estimation of calcium;	1.1 Chemistry of food flavor 1.2 Philosophy and definitions of flavor 1.3 flavourmatics 1.4 flavouring compounds, 1.5 sensory assessment of flavor 1.6 technology for flavor retention;	1.1. Use of flavor in food industry

SW-1 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT326.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: To gain knowledge on Food Pigments **S02.2.** To understand the Types of Food Colorants and natural vs synthetic colorant **SO2.3**: To understand the Regulations and Safety **SO2.4:** To explore Natural Color Extraction: and synthesis of synthetic colors **SO2.5:** To gain knowledge on Colorant Application and Health and Consumer Concerns	2.1. Determination of phosphorus; 2.2. Determination of iron;	2.1. Pigments in animal and plants kingdoms 2.2 Heme pigments, chlorophyll, carotenoids, phenolic and flavonoids , betalains 2.3 effect of processing on pigment behavior; 2.4 Technology for retention of natural colors of food stuffs; 2.5 Food colorants; Regulatory use of regulatory dyes; 2.6 Colour losses during thermal processing;	2.1. Use of colorant in food industry

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT326.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1: Describe the concepts of vitamins and minerals as essential micronutrients and explain their distinct roles in human nutrition. **S03.2.** Categorize vitamins and minerals into their respective classes (e.g., water-soluble and fat-soluble vitamins, major and trace minerals). **SO3.3:** Identify the primary functions of different vitamins, including roles in metabolism, immune support, and growth. **SO3.4:** Explain the critical functions of minerals in maintaining health, including their involvement in bone health, nerve function, and electrolyte balance. **SO3.5:** Dietary Sources; RDA and Deficiency and Toxicity	3.1. Estimation of magnesium 3.2. Estimation of tannins and phytic acid from food;	3.1. Vitamins and minerals: 3.2 equirements, allowances, 3.3. enrichment, restorations, 3.4. fortifications, 3.5. losses of vitamins and minerals, 3.6. optimization and retention of vitamins and minerals;	3.1. Essential organic compounds required in small amounts for various physiological functions.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT326.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1: To understand Definition and Types of Anti-nutritional Factors **S04.2.** To explore Chemical Structure and mechanism of action **SO4.3:** To gain knowledge on food source and health implications **SO4.4:** To understand the Food processing and Nutrient Enhancement Strategies **SO4.5:** Health Recommendations	4.1. Determination of vitamin A (Total carotenoids); 4.2. Determination of ascorbic acid by dye method;	4.1. to 4.6. Chemistry of anti-nutritional factors.	4.1. Relation between anti nutritional factors and human health

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT326.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1: To understand the Definition and Types of Food Enzymes **S05.2:** To gain the knowledge on Role of Enzymes in Food Processing **SO5.3:** To understand the mechanism of enzymes **SO5.4:** To gain the knowledge on Enzymes application in food industry **SO5.5:** To understand the Enzyme-Assisted Nutrient Modification	5.1. Determination of thiamin and riboflavin; 5.2. Determination of food colors;	5.1. Enzymes in food industry: Carbohydrases, 5.2. Enzymes in food industry: protease 5.3. Enzymes in food industry: lipases 5.4 Modification of food using enzymes 5.5. Role of endogenous enzymes in food quality, 5.6 Enzymes use as processing aid and ingredients	5.1. Enzymes and metabolic activities

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+SW+SL)
54FT326.1. Micronutrient Identification: Students will be able to identify and classify essential micronutrients, such as vitamins and minerals commonly found in foods.	6	4	1	1	8
54FT326.2: Chemical Structure and Properties: Understand the chemical structures, properties, and reactivity of different micronutrients, including their molecular compositions and functional groups.	6	4	1	1	8
54FT326.3: Micronutrient Bioavailability: Comprehend the factors affecting the bioavailability of micronutrients, including interactions with other nutrients, food matrices, and factors like pH.	6	4	1	1	8
54FT326.4: Micronutrient Stability: Evaluate the impact of environmental factors, such as light, temperature, and oxygen, on the stability and degradation of micronutrients in food products.	6	4	1	1	8
54FT326.5: Nutrient Interactions: Absorption and metabolism Analyze how micronutrients interact with one another and with macronutrients in food, and the consequences of these interactions for overall nutrition.	6	4	1	1	8
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to food flavor	5	3	2	10
CO-2	Pigments and food colorants	2	3	5	10
CO-3	Vitamins and minerals	2	3	5	10
CO-4	Anti- Nutritional Factors	2	3	5	10
CO-5	Application of enzymes in food industry	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Chemistry of Micronutrients will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Chemistry	H.-D. Belitz, W. Grosch and P. Schieberle	Springer-Verlag Berlin Heidelberg.	4th 2009
2	Food Chemistry	Owen R, Fennema.	Marcel Dekker, Inc., New York, USA	3rd 1996

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AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54FT326

Course Title: Food Chemistry of Micronutrients

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Micronutrient Identification: Students will be able to identify and classify essential micronutrients, such as vitamins and minerals commonly found in foods.	1	1	2	2	3	2	1	2	2	1	3	2	2	3	3	3

CO2: Chemical Structure and Properties: Understand the chemical structures, properties, and reactivity of different micronutrients, including their molecular compositions and functional groups	**1**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**2**
CO3: Micronutrient Bioavailability: Comprehend the factors affecting the bioavailability of micronutrients, including interactions with other nutrients, food matrices, and factors like pH	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**2**
CO4: Micronutrient Stability: Evaluate the impact of environmental factors, such as light, temperature, and oxygen, on the stability and degradation of micronutrients in food	**1**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**	**1**	**2**	**2**

products																
CO5: Nutrient Interactions: Analyze how micronutrients interact with one another and with macronutrients in food, and the consequences of these interactions for overall nutrition.	**2**	**2**	**2**	**1**	**1**	**3**	**3**	**3**	**1**	**1**	**2**	**2**	**3**	**2**	**2**	**2**

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 1 to 12 and PSO 1 to 4	**CO1:** Micronutrient Identification: Students will be able to identify and classify essential micronutrients, such as vitamins and minerals commonly found in foods.	**SOs 1-5**	4	Chemistry of food flavor, Philosophy and definitions of flavor, flavourmatics / flavouring compounds, sensory assessment of flavor, technology for flavor retention;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	**CO2:** Chemical Structure and Properties: Understand the chemical structures, properties, and reactivity of different micronutrients, including their molecular compositions and functional groups.	**SOs 1-5**	4	Pigments in animal and plants kingdoms, Heme pigments, chlorophyll, carotenoids, phenolic and flavonoids, betalains, effect of processing on pigment behavior; Technology for retention of natural colors of food stuffs, Food colorants; Regulatory use of regulatory dyes; Colour losses during thermal processing;	
PO 1 to 12 and PSO 1 to 4	**CO3:** Micronutrient Bioavailability: Comprehend the factors affecting the bioavailability of micronutrients, including interactions with other nutrients, food matrices, and factors like pH.	**SOs 1-5**	4	Vitamins and minerals: Requirements, allowances, enrichment, restorations, fortifications, losses of vitamins and minerals, optimization and retention of vitamins and minerals;	
PO 1 to 12 and PSO 1 to 4	**CO4:** Micronutrient Stability: Evaluate the impact of environmental factors, such as light, temperature, and oxygen, on the stability and degradation of micronutrients in food products.	**SOs 1-5**	4	Chemistry of anti-nutritional factors.	
PO 1 to 12 and PSO 1 to 4	**CO5:** Nutrient Interactions: Analyze how micronutrients interact with one another and with macronutrients in food, and the consequences of these interactions for overall nutrition.	**SOs 1-5**	4	Enzymes in food industry: Carbohydrases, protease, lipases; Modification of food using enzymes: Role of endogenous enzymes in food quality, enzymes use as processing aid and ingredients	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-III

Course Code:	54FT328
Course Title :	Unit Operations of Food Processing-I
Pre- requisite:	Students should have basic knowledge of different unit operation for processing of raw material and for value addition of finished product.
Rationale:	The students studying Unit Operations of Food Processing-I i.e. a scientific discipline that focuses on the application of different unit operation that is interlinked to furnish product of entire processing which enhanced its market value. The field is also comprises about classification of different unit operation in food that applicable for processing industry also.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT328.1	To understand concept of size reduction along with different size reduction , used as milling equipments.
54FT328.2	To understand the basic concept of mixing type unit operation and also describe about different mixing equipment that essential any food processing industry.
54FT328.3	Acquired the knowledge for mechanical separation type unit operation such as sieving, centrifugation, and sedimentation and filtration technique.
54FT328.4	To understand the concept of different types of filtration techniques according to application of constant pressure and constant time.
54FT328.5	To understand different types of membrane separation techniques along with application of diffusion process.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT328	Unit Operations of Food Processing-I	2	2	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2+ ESPA+ESE)
			SA1	SA2			
PCFT	54FT328	Unit Operations of Food Processing-I	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT328.1:

Item	CL	LI	SW	SL	Total
Appro. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the Size reduction: Benefits, lassification, determination and designation of the fineness of ground material, sieve/screen analysis SO1.2 Understand theprinciple and mechanisms of comminution of food, Rittinger's, Kick's and Bond's equations, work index, energy utilization; SO1.3 Understand the Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), SO1.4 Understand hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders SO1.5 Understand fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping);	1.1. Determination of fineness modulus and uniformity index 1.2. To study about different type of size reduction equipments	1.1 Size reduction 1.2 Rittinger's, Kick's 1.3. Bond's equations 1.4 Size reduction equipment 1.5 hammer mills and impactors 1.6 cutting machines	1.1. Knowledge about various principles of size reduction

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Notes –

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT328.2:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing SO2. Understand the theory of liquid mixing, power requirement for liquids mixing SO2.3 Understand the equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators SO2.4 Understand the powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, SO2.5 Understand the mixers for dry powders and particulate solids	2.1. Determination of mixing index of a feed mixer 2.2. To study about different types of mixing equipments	2.1theory of solids mixing 2.2 rate of mixing 2.3 theory of liquid mixing 2.4 power requirement for liquids mixing 2.5 Mixers for low- or medium-viscosity liquids 2.6 powder-liquid contacting devices and mixers for dry powders	2.1. Knowledge about agitators that applicable in food industry

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT328.3:

Item	CL	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the Mechanical Separations: Theory SO3.2 Understand the centrifugation, liquid-liquid centrifugation SO3.3 Understand the liquid-solid centrifugation, SO3.4 Understand the clarifiers, desludging SO3.5 Understand the decanting machines	3.1. Introduction about working principle of centrifuge 3.2. To study about sedimentation technique in detail	3.1 Mechanical Separations: Theory 3.2 liquid-liquid centrifugation 3.3 liquid-solid centrifugation 3.4 clarifiers 3.5 desludging machine 3.6 decanting machines	3.1. Knowledge about centrifugation technique in detail

SW-3 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT328.4

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the Filtration Theory of filtration, rate of filtration SO4.2 Understand the pressure drop during filtration, applications, constant-rate filtration SO4.3 Understand the constant-pressure filtration, derivation of equation SO4.4 Understand the Filtration equipment; plate and frame filter press, rotary filters SO4.5 Understand the centrifugal filters and air filters, filter aids	4.1. Introduction to different types of filtration equipment 4.2. To study about rate of filtration	4.1 Filtration Theory 4.2 rate of filtration 4.3 pressure drop during 4.4 constant-rate filtration 4.5 constant-pressure filtration 4.6 Filtration equipment; centrifugal filters	4.1. Knowledge about d rate of filtration that based on the theory of Darcy law

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT328.5:

Item	CI	LI	SW	SL	Total
Aprox Hrs	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand the Membrane separation, General considerations, materials for membrane construction, ultra-filtration, processing SO5.2 Understand the membrane fouling, applications of ultra-filtration in food processing SO5.3 Understand the reverse osmosis, mode of operation, and applications SO5.4 Understand the Membrane separation methods, demineralization by electro-dialysis, SO5.5 Understand the gel filtration, ion exchange, per-evaporation and micro filtration	5.1. Study of reverse osmosis process 5.2. Study of ultra filtration/membrane separation process.	5.1 Theory of Membrane separation 5.2 membrane fouling 5.3 reverse osmosis 5.4 Membrane separation methods 5.5 Per-evaporation 5.6. Micro filtration	5.1. Knowledge about Reverse osmosis plant for purification o water.

SW-5 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+SW+SL)
54FT328.1: Explain about concept of size reduction along with different size reduction which is also known as milling equipments	6	4	1	1	12
54FT328.2: Explain the basic concept of mixing type unit operation and also describe about different mixing equipment that essential any food processing industry.	6	4	1	1	12
54FT328.3: Acquired the knowledge for mechanical separation type unit operation such as sieving, centrifugation, and sedimentation and filtration technique.	6	4	1	1	12
54FT328.4: Explain the concept of different types of filtration techniques according to application of constant pressure and constant time.	6	4	1	1	12
54FT328.5: Explain about different types of membrane separation techniques along with application of diffusion process	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Concept of size reduction and size reduction equipment	5	3	2	10
CO-2	Briefing about mixing theory	2	3	5	10
CO-3	Detailing about mechanical separation technique	2	3	5	10
CO-4	Concept about filtration technique	2	3	5	10
CO-5	Membrane separation technique	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Unit operations in Food processing will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Unit Operations of Chemical Engineering	Warren L. McCabe, Julian Smith, Peter Harriott	McGraw-Hill, Inc., NY, USA	2004,7th
2	Transport Processes and Separation Process Principles	Christie John Geankoplis.	Prentice-Hall, NY, USA	2003, 4th
3	Handbook of Food Processing Equipment.	George D. Saravacos and Athanasios E. Kostaropoulos	Business Media, New York, USA	2002, 2nd
4	Chemical Engineering, Vol. 2, Particle Technology and Separation Processes	J. F. Richardson, J. H. Harker and J. R. Backhurst	. Butterworth–Heinemann, Oxford, UK.	2002, 5th

Curriculum Development Team

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AKS University

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54FT328

Course Title: Unit operation in Food Processing I

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Explain about concept of size reduction along with different size reduction which is also known as milling equipments.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Explain the basic concept of mixing type unit operation	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

and also describe about different mixing equipment that essential any food processing industry.																
CO3: Acquired the knowledge for mechanical separation type unit operation such as sieving, centrifugation, and sedimentation and filtration technique	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Explain the concept of different types of filtration techniques according to application of constant pressure and constant time.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Explain about different types of membrane separation techniques along with application of diffusion process	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

Course Outcome Map

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1,6 and,10 PSO 1,2, 3, 4	Explain about concept of size reduction along with different size reduction which is also known as milling equipments.	**SOs 1-5**	**LI 1-2**	Size reduction, Rittinger's, Kick's and Bond's equations, Size reduction equipment, hammer mills and impactors, cutting machines	**As mentioned in page number 3 to 7**
PO 1.2,8 and 12 PSO 1,2, 3, 4	Explain the basic concept of mixing type unit operation and also describe about different mixing equipment that essential any food processing industry.	**SOs 1-5**	**LI 1-2**	theory of solids mixing, rate of mixing, theory of liquid mixing, power requirement for liquids mixing, Mixers for low- or medium-viscosity liquids, powder-liquid contacting devices, mixers for dry powders	
PO 1,2, 6 and 5 PSO 1,2, 3, 4	Acquired the knowledge for mechanical separation type unit operation such as sieving, centrifugation, and sedimentation and filtration technique	**SOs 1-5**	**LI 1-2**	Mechanical Separations: Theory liquid-liquid centrifugation liquid-solid centrifugation, clarifiers, decanting machines	
PO 1, 3, 6, 7 and 11 PSO 1,2, 3, 4	Explain the concept of different types of filtration techniques according to application of constant pressure and constant time.	**SOs 1-5**	**LI 1-2**	Filtration Theory rate of filtration, pressure drop during constant-rate filtration, constant-pressure filtration, Filtration equipment;, centrifugal filters	
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	Explain about different types of membrane separation techniques along with application of diffusion process	**SOs 1-5**	**LI 1-2**	Theory of Membrane separation, membrane fouling, reverse osmosis, Membrane separation methods, per-evaporation and micro filtration	

AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

Semester-III

Course Code:	54FT378
Course Title :	Skill Development (Bakery)- Lab
Pre- requisite:	Students should have basic knowledge of bakery including with different types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing of various bakery products. They have to develop employability skills, intellectual skills, core of key skills and personal attributes with full responsibility and self-confidence.
Rationale:	The students studying Food Technology should possess foundational understanding about bakery products including with their processing, packaging and storage conditions.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT378.1	Ability to develop employability skills in the field of bakery.
54FT378.2	Ability to enhance technical knowledge and skills in the field of bakery.
54FT378.3	Ability to assess the quality of bakery products.
54FT378.4	Ability to recall the standards and regulations of bakery industries.
54FT378.5	Ability to demonstrate skills in bakery industries.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT378	Skill Development (Bakery)- Lab	0	2	0	0	0	1

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment (ESPAV) Viva	Practical Assessment (ESPAR) Records	Total Marks (SA1+SA2+ESPA+ESE)
PCFT	54FT378	Skill Development (Bakery)- Lab	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment

The end of semester assessment, the student will be required to prepare a detailed Project Report on Skill Development (Bakery). The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Making Project Report and Power Point Presentation on the same skill.
2. Take guidance of concerned teacher that assigned for the same subject.

Curriculum Development Team

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AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54FT378

Course Title: Skill Development Bakery

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO 1: Ability to develop employability skills in the field of bakery.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO 2: Ability to enhance technical knowledge and skills in	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3

the field of bakery.																
CO 3: Ability to assess the quality of bakery products.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO 4: Ability to recall the standards and regulations of bakery industries.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO 5: Ability to demonstrate skills in bakery industries.	3	2	2	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

Course Curriculum Map

POs & PSOs No.	COs No.& Titles	SOs No.	Lab. Instruction(LI)	Classroom Instruction(CI)	Self Learning
PO 1,6 and,10 PSO 1,2, 3, 4	CO 1: Ability to develop employability skills in the field of bakery.				
PO 1.2,8 and 12 PSO 1,2, 3, 4	CO 2: Ability to enhance technical knowledge and skills in the field of bakery.				
PO 1,2, 6 and 5 PSO 1,2, 3, 4	CO 3: Ability to assess the quality of bakery products.				
PO 1, 3, 6, 7 and 11 PSO 1,2, 3, 4	CO 4: Ability to recall the standards and regulations of bakery industries.				
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	CO 5: Ability to demonstrate skills in bakery industries.				

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT421
Course Title :	Processing Technology of Pulses & Oilseeds
Pre- requisite:	Students should have knowledge of different unit operation used for processing of raw material as well as value addition of finished product.
Rationale:	The students studying Processing Technology of Pulses & Oilseeds is the application of different unit operation that is interlinked with value added finished products and also lies in its potential to enhance economic outcomes for farmers, improve food security and nutrition, reduce waste, and contribute to the overall development of the agricultural and agro-processing sectors.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT421.1	Understand the food processing, and nutrition, addressing challenges and optimizing the potential benefits of legumes and oilseeds.
54FT421.2	Knowledge about challenges in pulse milling, optimizes nutritional quality, and develops efficient processing methods for various pulse products.
54FT421.3	Apply the knowledge to enhance soybean products, develop fermented legume variations, optimize oilseed milling processes, and troubleshoot issues in the oil milling industry for improved productivity and quality.
54FT421.4	Understand the traditional oil refining processes, advanced technologies in oilseed processing and their practical applications.
54FT421.5	Understand the value addition processes, utilization of by-products and ways to create high-value food products from oilseed meals and residues.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT421	Processing Technology of Pulses & Oilseeds	3	2	1	1	6	4

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks
			SA 1	SA2			
PCFT	54FT 421	Processing Technology of Pulses & Oilseeds	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT421.1:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the present status and future prospects of legumes and oilseeds. **SO1.2** Understand the morphology of legumes and oilseeds. **SO1.3** Acquire the knowledge of chemical composition of legumes and oilseeds. **SO1.4** Knowledge about antinutritional compounds of legumes and oilseeds. **SO1.5** Apply the knowledge on methods of removal of antinutritional compounds.	1.1 To determine the physical properties of selected oilseed. 1.2 To study about chemical composition of pulses.	1.1 Present status of legumes and oilseeds. 1.2 Future prospects of legumes and oilseeds. 1.3 Morphology of legumes and oilseeds. 1.4 Classification of legumes and oilseeds. 1.5 Types of legumes and oilseeds. 1.6 Chemical composition. 1.7 Nutritional value of legumes and oilseeds. 1.8 Antinutritional compounds of legumes and oilseeds. Methods of removal of anti-nutritional compounds.	1.1 Knowledge about the state wise production scenario of pulses & oilseeds in India.

SW-1 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT421.2:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the various methods of pulse milling. **SO2.2** Knowledge about factors affecting milling efficiency. **SO2.3** Understand the problems in dhal milling industry. **SO2.4** Apply the knowledge on nutritional changes during soaking and sprouting. **SO2.5** Understand the factors affecting cooking quality of dhal.	2.1 Study of mini dhal mill. 2.2 Study of cooking quality of dhal.	2.1 Pulse milling: Home scale and cottage scale. 2.2 Traditional milling methods. 2.3 Modern milling methods, machines, milling quality. 2.4 Milling efficiency. 2.5 Factors affecting milling quality and quantity. 2.6 Problems in dhal milling industry. 2.7 Nutritional changes during soaking and sprouting of pulses. 2.8 Cooking quality of dhal, methods, factors affecting cooking of dhal. Quick cooking dhal, instant dhal	2.1Knowledge about the determination of milling efficiency.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT421.3:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the processing and value addition of soybean milk. SO3.2 Understand the fermentation process and legume based fermented products. SO3.3 Understand the milling process of oilseed. SO3.4 Understand the problems in oil milling industry. SO3.5 Understand the desolventization process.	3.1 To study about mini oil mill. 3.2 To study about removal of anti-nutritional compound from oilseed.	3.1 Soybean milk processing. 3.2 Value addition. 3.3 Fermented products of legumes. 3.4 Oil seed milling: Ghanis 3.5 Hydraulic presses and Expellers 3.6 Solvent extraction methods. 3.7 Machines, milling quality, milling efficiency, factors affecting milling quality and quantity. 3.8 Problems in oil milling industry. Desolventization	3.1 Knowledge about the production of tofu.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT421.4

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the working principle and methods of degumming and neutralization. SO4.2 Understand the types and methods of filtration. SO4.3 Understand the working principle and methods of bleaching and deodorization. SO4.4 Understand the hydrogenation of oil. SO4.5 Understand the new technologies in oilseed processing industries.	4.1 To determine the FFA of oil. 4.2 To study about the hydrogenation of oil.	4.1 Refining of oils. 4.2 Degumming principle and methods. 4.3 Neutralization principle and methods. 4.4 Types and methods of filtration. 4.5 Bleaching principle and methods. 4.6 Deodorization. 4.7 Hydrogenation of oils. 4.8 Methods and types of hydrogenation.New technologies in oilseed processing.	4.1 Knowledge about need and importance of refining.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT421.5:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand the by-product utilization of oilseed meal. SO5.2 Understand the protein concentrates. SO5.3 Understand the protein isolates. SO5.4 Understand the by-product utilization of pulses. SO5.5 Understand the value addition of by-products of pulses.	5.1 To study about by-product utilization of oilseed meal. 5.2 To study about by-product utilization of pulses.	5.1Utilization of oil seed meals for feeding. 5.2Utilization of oil seed meal for food. 5.3High protein products like protein concentrates. 5.4Method of preparation of protein concentrates. 5.5Protein isolates 5.6Method of preparation of protein isolates. 5.7By-product utilization of pulses for feeding. 5.8By-product utilization of pulses for food.Various methods of Value addition of by-products.	5.1 Knowledge about need and importance of by-product utilization of pulses.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT421.1: Understand the food processing, and nutrition, addressing challenges and optimizing the potential benefits of legumes and oilseeds.	8	4	1	1	14
54FT421.2: Knowledge to address challenges in pulse milling, optimize nutritional quality, and develop efficient processing methods for various pulse products.	8	4	1	1	14
54FT421.3: Apply the knowledge to enhance soybean products, develop fermented legume variations, optimize oilseed milling processes, and troubleshoot issues in the oil milling industry for improved productivity and quality.	8	4	1	1	14
54FT421.4: Understand the traditional oil refining processes, advanced technologies in oilseed processing and their practical applications.	8	4	1	1	14
54FT421.5: Understand the value addition processes, utilization of by-products and ways to create high-value food products from oilseed meals and residues.	8	4	1	1	14
Total	40	20	5	5	70

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to production status, morphology and chemical composition of legumes and oilseeds	5	3	2	10
CO-2	Detailing about various methods of pulse milling and problems in milling industry	2	3	5	10
CO-3	Processing and value addition of soybean and oilseed milling	2	3	5	10
CO-4	Refining of oils	2	3	5	10
CO-5	By-product utilization of oilseed and pulses	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing Technology of Pulses and Oilseeds will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Unit Operations of Agricultural Processing	K.M. Sahay and K.K. Singh	Vikas Publishing House Pvt. Ltd., Noida	2001, 2nd Ed.
2	Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices	Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy	Marcel Dekker, Inc., NY, USA	2003
3	Post Harvest Technology of Cereals, Pulses and Oilseeds	A. Chakraverty	Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi	2008, 3rd Ed.
4	Bailey's Industrial Oil & Fat Products	Fereidoon Shahidi	John Wiley and Sons, Inc. Hoboken, New Jersey, USA	2005, 6th Ed., Vols. 1 to 6

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT421
Course Title: Processing Technology of Pulses & Oilseeds

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Understand the food processing, and nutrition, addressing challenges and optimizing the potential benefits of legumes and oilseeds.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2 Knowledge to address challenges in pulse milling, optimize nutritional quality, and develop efficient processing methods for various pulse products.	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO3: Apply the knowledge to enhance soybean products, develop fermented legume	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3

variations, optimize oilseed milling processes, and troubleshoot issues in the oil milling industry for improved productivity and quality.																
CO4: Understand the traditional oil refining processes, advanced technologies in oilseed processing and their practical applications.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Understand the value addition processes, utilization of by-products and ways to create high-value food products from oilseed meals and residues.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 1 to 12 and PSO 1 to 4	CO1: Understand the food processing, and nutrition, addressing challenges and optimizing the potential benefits of legumes and oilseeds.	**SOs 1-5**	4	Unit-I Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds; Chemical composition, nutritional value and anti-nutritional compounds in legumes and oilseeds; Methods of removal of anti-nutritional compounds.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2 Knowledge to address challenges in pulse milling, optimize nutritional quality, and develop efficient processing methods for various pulse products.	**SOs 1-5**	4	Unit-II Pulse milling: Home scale, cottage scale and modern milling methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in dhal milling industry; Nutritional changes during soaking and sprouting of pulses; Cooking quality of dhal, methods, factors affecting cooking of dhal; Quick cooking dhal, instant dhal	
PO 1 to 12 and PSO 1 to 4	CO3: Apply the knowledge to enhance soybean products, develop fermented legume variations, optimize oilseed milling processes, and troubleshoot issues in the oil milling industry for improved productivity and quality.	**SOs 1-5**	4	Unit-III Soybean milk processing and value addition; Fermented products of legumes; Oil seed milling: Ghanis, hydraulic presses, expellers, solvent extraction methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in oil milling industry; Desolventization.	
PO 1 to 12 and PSO 1 to 4	CO4: Understand the traditional oil refining processes, advanced technologies in oilseed processing and their practical applications.	**SOs 1-5**	4	Unit-IV Refining of oils: Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls; Hydrogenation of oils; New technologies in oilseed processing.	
PO 1 to 12 and PSO 1 to 4	CO5: Understand the value addition processes, utilization of by-products and ways to create high-value food products from oilseed meals and residues.	**SOs 1-5**	4	Unit-V Utilization of oil seed meals for different food uses: High protein products like protein concentrates and isolates; By-products of pulse and oil milling and their value addition.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT422
Course Title :	Food Biochemistry and Nutrition
Pre- requisite:	Students should have basic knowledge of various metabolisms of Human body and nutritional demand.
Rationale:	This course will enhance your understanding of the process by which energy is derived from carbohydrates, proteins, and fat molecules in the human body. It will cover the breakdown and synthesis of molecules, as well as the essential role of other molecules such as enzymes, minerals, and vitamins in the utilization of these molecules. Student will also gain a comprehensive understanding of the structure of DNA, RNA, and hormones, as well as their respective roles and functions within living organisms.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT422.1	Define the nutrition and healthy diet planning concepts.
54FT422.2	Explain the importance of nutrition.
54FT422.3	Describe the elements of nutrients.
54FT422.4	Summarize the deficiencies of nutrition.
54FT422.5	Explain the digestion, absorption and transports in blood circulation of nutrients.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT422	Food Biochemistry and Nutrition	3	2	1	1	6	4

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 422	Food Biochemistry and Nutrition	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT422.1:

Items	**CL**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 Understand Evolution and scope of Biochemistry SO1.2 Understand Cellular Biochemistry SO1.3 Understanding the Carbohydrates classification SO1.4 Understanding the Protein classification SO1.5 Understanding the Lipid classification	1.1 Preparation of various solutions and buffers 1.2 Qualitative and quantitative determination of carbohydrates	1.1 Biochemistry 1.2 Scope of Biochemistry 1.3. Cellular biochemistry 1.4 Carbohydrates: Occurrence 1.5 Classification and structures, physicochemical and metabolic functions, 1.6 Metabolism 1.7 Proteins: Occurrence, classification and structures, physicochemical and metabolic functions, Metabolism 1.8 Lipids: Occurrence, classification and structure, physicochemical and metabolic functions, metabolism	1.1. Knowledge about various Digestion and Absorption chemical changes

SW-1 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT422.2:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand Nucleic Acids SO2.2 Understand vitamins and Minerals SO2.3 Understanding detail about Enzymes SO2.4 Understanding basic concept of Nutrition SO2.5 Understanding Water as Nutrition.	2.1. Qualitative and quantitative determination of amino acids 2.2. Qualitative and quantitative determination of proteins	2.1 Nucleic acids: Properties 2.2 Structure and metabolism 2.3 Vitamins and minerals: Chemistry and metabolic functions 2.4 Enzymes: Chemical nature and nomenclature 2.5 Classification, sources and properties, mechanism of action 2.6 Coenzyme and prosthetic groups 2.7 Concepts and content of nutrition: metabolic function of nutrients 2.8 Water and energy balance, water intake and losses, basal metabolism	2.1 Knowledge about various structures of DNA

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT422.3:

Items	**CL**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-3**	**Self Learning (SL)**
SO3.1 Understand Formulation of diet SO3.2 Understand balanced diet SO3.3 Understanding Recommended dietary allowances SO3.4 Understanding Malnutrition SO3.5 Understanding Potentially toxic substance in human food	3.1. Qualitative and quantitative determination of lipids 3.2. Qualitative and quantitative determination of vitamins	3.1. Formulation of diets, classification of balanced diet 3.2. Preparation of balanced diet for various groups 3.3. Recommended dietary allowances for various age groups 3.4. Malnutrition; Assessment of nutritional status 3.5 Food fad and faddism 3.6. Potentially toxic substance in human food 3.7 Functions of food 3.8 Basic food groups; nutrients supplied by food	3.1 Knowledge about various dietary requirements

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT422.4

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand Nucleic acid and its types SO4.2 Understand Fats in Human Body SO4.3 Understanding Metabolic cycles of Proteins SO4.4 Understanding Metabolic cycles of Lipids SO4.5 Understanding Metabolic cycles of Carbohydrates.	4.1. Isolation of enzymes from various sources 4.2. Measurement of energy using bomb calorimeter	4.1. Nucleic acids; 4.2 Nutrients: Sources, functions, digestion, absorption, assimilation 4.3 Transport of carbohydrates 4.4 Proteins and fats in human beings 4.5 Metabolism of carbohydrates 4.6 Biological role of carbohydrates, glycolysis and respiration 4.7 Production of ATP 4.8 Brief description of electron transport chain, oxidative and substrate phosphorylation	4.1 Knowledge about Metabolism of Food

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT422.5:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Physico-chemical Changes during processing SO5.2 Understand nutritional changes during processing SO5.3 Understanding Changes during food processing treatment SO5.4 Understanding Fortification of Food SO5.5 Understanding supplementation of foods	5.1. Determination of pI for casein 5.2. Estimation of sugars by Anthrone method.	5.1 Physico-chemical changes 5.2 Nutritional changes during processing 5.3 Changes during food processing treatment of drying 5.4 Dehydration, irradiation 5.5 Freezing, fermentation 5.6 Canning, restoration, enrichment 5.7 Fortification 5.8 Supplementation of foods	5.1 Knowledge about various techniques for Processing of Food

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT422.1: Define the nutrition and healthy diet planning concepts.	8	4	1	1	14
54FT422.2: Explain the importance of nutrition.	8	4	1	1	14
54FT422.3: Describe the elements of nutrients.	8	4	1	1	14
54FT422.4: Summarize the deficiencies of nutrition.	8	4	1	1	14
54FT422.5: Explain the digestion, absorption and transports in blood circulation of nutrients.	8	4	1	1	14
Total	40	20	5	5	70

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Biochemistry and its Components	5	3	2	10
CO-2	Micronutrients and its classification	2	3	5	10
CO-3	Nutrition and Balanced Diet	2	3	5	10
CO-4	Metabolism	2	3	5	10
CO-5	Processing in Food	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Biochemistry and Nutrition will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Wardlaw's Perspectives in Nutrition: A Functional Approach	Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner	McGraw-Hill, Inc., NY, USA	2013
2	Lehninger Principles of Biochemistry	David L. Nelson and Michael M. Cox	Macmillan Learning, NY, USA	2012, 6th Ed
3	Biochemistry	Donald Voet and Judith G. Voet	John Wiley and Sons, Inc., NY, USA	2011, 4th Ed
4	Handbook of Nutrition and Food	Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer	CRC Press, Boca Raton, FL, USA	2008, 2nd Ed

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54FT422

Course Title: Food Biochemistry and Nutrition

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Biochemistry and its Components	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Micronutrients and its classification	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO3: Nutrition and Balanced Diet	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Metabolism	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Processing in Food	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Biochemistry and its Components	**SOs 1-5**	4	Biochemistry and its scope, cellular biochemistry; Carbohydrates: Occurrence, classification and structures, physicochemical and metabolic functions, metabolism; Proteins: Occurrence, classification and structures, physicochemical and metabolic functions, metabolism; Lipids: Occurrence, classification and structure, physicochemical and metabolic functions, metabolism	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Micronutrients and its classification	**SOs 1-5**	4	Nucleic acids: Properties, structure and metabolism; Vitamins and minerals: Chemistry and metabolic functions; Enzymes: Chemical nature and nomenclature, classification, sources and properties, mechanism of action, coenzyme and prosthetic groups; Concepts and content of nutrition: metabolic function of nutrients; Water and energy balance, water intake and losses, basal metabolism	
PO 1 to 12 and PSO 1 to 4	CO3: Nutrition and Balanced Diet	**SOs 1-5**	4	Formulation of diets, classification of balanced diet, preparation of balanced diet for various groups; Recommended dietary allowances for various age groups; Malnutrition; Assessment of nutritional status; Food fad and faddism; Potentially toxic substance in human food; Functions of food; Basic food groups; nutrients supplied by food	
PO 1 to 12 and PSO 1 to 4	CO4: Metabolism	**SOs 1-5**	4	Nucleic acids; Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings; Metabolism of carbohydrates: Biological role of carbohydrates, glycolysis and respiration, production of ATP, brief description of electron transport chain, oxidative and substrate phosphorylation	
PO 1 to 12 and PSO 1 to 4	CO5: Processing in Food	**SOs 1-5**	4	Physico-chemical and nutritional changes during processing: Changes during food processing treatment of drying and dehydration, irradiation, freezing, fermentation, canning, restoration, enrichment, fortification and supplementation of foods	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT423
Course Title :	Unit Operations of Food Processing-II
Pre- requisite:	Students should have advance knowledge of different unit operation for processing of raw material and for value addition of finished product.
Rationale:	The students studying Unit Operations of Food Processing-II i.e. a scientific discipline that focuses on the application of different unit operation that is interlinked to furnish product of entire processing which enhanced its market value. The field is also comprises about classification of different unit operation into advance level in food that applicable for processing industry also.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT423.1	Explain about concept of evaporation along with its principle and different properties of liquor for analysis of mass and energy balance.
54FT423.2	Explain the basic concept of different types of evaporator which is also called evaporation equipments that's are essential any food processing industry along with their feeding mechanism.
54FT423.3	Acquired the knowledge for food freezing system with analysis to effect of freezing on the quality of food product and also discuss about Plank's law for freezing time.
54FT423.4	Explain the concept of cooking of food along with different types of cooking and also discuss about pasteurization process in detail.
54FT423.5	Explain about different types of thermal heat treatment in food such as sterilization, blanching and canning etc.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT423	Unit Operations of Food Processing-II	3	2	1	1	6	4

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 423	Unit Operations of Food Processing-II	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT423.1:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the Principles of evaporation, mass and energy balance SO1. 2 Understand the factors affecting rate of evaporation, thermodynamics of evaporation SO1.3 Understand the phase change, boiling point elevation, Dühring plot; Heat and mass transfer in evaporator SO1.4 Understand the factors influencing the overall heat transfer coefficient SO1.5 Understand the influence of feed liquor properties on evaporation.	1.1 Study of working principle open pan and evaporator 1.2 Study of heat/mass balance during concentration of liquid foods	1.1 Principles of evaporation 1.2 Mass and energy balance 1.3 factors affecting rate of evaporation 1.4 Thermodynamics of evaporation 1.5 boiling point elevation 1.6 Heat and mass transfer in evaporator 1.7 overall heat transfer coefficient 1.8 factors influencing the overall heat transfer feed liquor properties on evaporation.	1.1 Knowledge about boiling point of different liquid with Duhring rule

SW-1 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT423.2:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the Evaporation equipment, Natural circulation evaporators SO2 Understand the horizontal/vertical short tube, natural circulation with external calandria, SO2.3 Understand the long tube, forced circulation; single effect, multiple effect evaporators, SO2.4 Understand the feeding methods of multiple effect, evaporation systems SO2.5 Understand the feed preheating, vapour recompression systems; Fouling of evaporators and heat exchanges.	2.1 Study of multiple effect evaporator 2.2 Study of heat exchanges	2.1 Evaporation equipment 2.2 Natural circulation evaporators 2.3 horizontal/vertical short tube 2.4 natural circulation with external calandria, 2.5 single effect 2.6 multiple effect evaporators, 2.7 feeding methods of evaporators 2.8 vapour recompression systems; Fouling of evaporators and heat exchanges.	2.1 Knowledge of different heat exchanger that applicable for milk plant

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT423.3:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the Food freezing: Introduction, freezing point curve for food and water SO3.2 Understand the freezing points of common food materials, Principles of food freezing, freezing time calculation by using Plank's equation SO3.3 Understand the Freezing systems direct contact systems, air blast immersion; Changes in foods; Frozen food properties; freezing time, factors influencing freezing time SO3.4 Understand the freezing/thawing time; Freeze concentration: Principles, process, methods; Frozen food storage: Quality changes in foods during frozen storage; SO3.5 Understand the Freeze drying: Heat mass transfer during freeze drying, equipment and practice.	3.1 To study about different types of freezing equipments. 3.2 Determination of freezing time of a food material	3.1 Freezing Introduction 3.2 point curve for food and water 3.3 freezing points of common food materials freezing time 3.4 Freezing systems 3.5 Frozen food properties 3.6 freezing time 3.7 Freeze concentration 3.8 Quality changes in foods during frozen storage, Freeze drying	3.1 Knowledge about application of freeze drying process

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT423.4

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the Baking Principles, baked foods, baking equipment; Roasting SO4.2 Understand the Principles of roasting, roasting equipment; Frying: theory and principles, shallow or contact frying and deep fat frying, SO4.3 Understand the heat and mass transfer in frying, frying equipment; Puffing: Puffing methods, puffing equipment; SO4.4 Understand the Pasteurization: Purpose, microorganisms and their reaction to temperature and other influences, methods of heating, SO4.5 Understand the design and mode of operation of heating equipment, vat, tubular heat exchanger, plate heat exchanger.	4.1 To study about different methods of cooking 4.2 To study about HTST pasteurization of milk	4.1 Baking Principles 4.2 baking equipment 4.3 Principles of roasting 4.4 roasting equipment 4.5 heat and mass transfer in frying 4.6 Puffing methods 4.7 Pasteurization objective 4.8 heat exchanger, types of heat exchanger	4.1 Knowledge of puffing for preparation of bread

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT423.5:

Items	CL	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand the Sterilization Principles, process time, T-evaluation SO5.2 Understand the design of batch and continuous sterilization, SO5.3 Understand the different methods and equipments; UHT sterilization, in the package sterilization, SO5.4 Understand the temperature and pressure patterns, equipment for sterilizing goods in the package SO5.5 Understand the Blanching: principle and equipment	5.1 Numerical problem on thermo bacteriology (D, Z and F value) 5.2.To study about different types of blanching equipments	5.1 Sterilization Principles 5.2 Values of Sterilization 5.3 design of sterilization 5.4 UHT sterilization, 5.5 package equipments 5.6 Sterilization equipments 5.7 temperature and pressure patterns 5.8 Blanching and its Blanching equipments	5.1 Knowledge about application of different sterilization values in food

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT423.1: Explain about concept of evaporation along with its principle and different properties of liquor for analysis of mass and energy balance.	8	4	1	1	14
54FT423.2: Explain the basic concept of different types of evaporator which is also called evaporation equipments that's are essential any food processing industry along with their feeding mechanism	8	4	1	1	14
54FT423.3: Acquired the knowledge for food freezing system with analysis to effect of freezing on the quality of food product and also discuss about Plank's law for freezing time. .	8	4	1	1	14
54FT423.4: Explain the concept of cooking of food along with different types of cooking and also discuss about pasteurization process in detail	8	4	1	1	14
54FT423.5: Explain about different types of thermal heat treatment in food such as sterilization, blanching and canning etc.	8	4	1	1	14
Total	40	20	5	5	70

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Concept of principle of evaporation and boiling point elevation of different food products	5	3	2	10
CO-2	Detailing about different types of evaporators	2	3	5	10
CO-3	Concept of food freezing	2	3	5	10
CO-4	Detailing about different methods of cooking and pasteurization process	2	3	5	10
CO-5	Thermal heat treatment of food	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Unit operation in Food Processing will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Introduction to Food Engineering	R. Paul Singh and Dennis R. Heldman	Elsevier,Amsterdam, The,Netherlands.	2014, 5th
2	Unit Operations of Chemical Engineering	Warren L. McCabe, Julian Smith, Peter Harriott	McGraw-Hill, Inc., NY, USA.	2004, 7th
3	Unit Operations in Food Engineering	Albert Ibarz and Gustavo V. Barbosa-Cánovas	CRC Press, Boca Raton, FL, USA.	2003, 5th
4	Transport Processes and Separation Process Principles	Christie John Geankoplis	. . Prentice-Hall, NY, USA.	2003, 3rd

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT423
Course Title: Unit Operations of Food Processing-II

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Concept of evaporation along with its principle and properties.	3	2	2	1	2	3	2	3	3	3	1	2	3	3	3	3
CO2: Basic concept of different types of evaporator with their feeding mechanism.	3	3	2	1	3	3	2	1	2	2	1	1	3	3	3	3
CO3: Knowledge for food freezing system with analysis to effect of freezing on the quality.	3	3	2	1	3	1	1	1	2	2	3	3	3	3	3	3
CO4: Concept of cooking of food along	3	1	3	1	3	2	3	1	3	3	1	3	3	3	3	3

with different types of cooking and also discuss about pasteurization process in detail.																
CO5: Different types of thermal heat treatment in food such as sterilization, blanching and canning etc.	3	2	2	1	3	2	2	3	2	2	1	1	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 1,6 and,10 PSO 1,2, 3, 4	Concept of evaporation along with its principle and properties.	SOs 1-5	LI 1-2	Evaporation: Principles of evaporation, mass and energy balance, factors affecting rate of evaporation, thermodynamics of evaporation (phase change, boiling point elevation, Dühring plot; Heat and mass transfer in evaporator, factors influencing the overall heat transfer coefficient, influence of feed liquor properties on evaporation.	As mentioned in page number 3 to 7
PO 1.2,8 and 12 PSO 1,2, 3, 4	Basic concept of different types of evaporator with their feeding mechanism.	SOs 1-5	LI 1-2	Evaporation equipment: Natural circulation evaporators, horizontal/vertical short tube, natural circulation with external calandria, long tube, forced circulation; single effect, multiple effect evaporators, feeding methods of multiple effect evaporation systems, feed preheating, vapour recompression systems; Fouling of evaporators and heat exchanges.	
PO 1,2, 6 and 5 PSO 1,2, 3, 4	Knowledge for food freezing system with analysis to effect of freezing on the quality.	SOs 1-5	LI 1-2	Food freezing: Introduction, freezing point curve for food and water, freezing points of common food materials, Principles of food freezing, freezing time calculation by using Plank's equation; Freezing systems; Direct contact systems, air blast immersion; Changes in foods; Frozen food properties; freezing time, factors influencing freezing time, freezing/thawing time; Freeze concentration: Principles, process, methods; Frozen food storage: Quality changes in foods during frozen storage; Freeze drying: Heat mass transfer during freeze drying, equipment and practice.	
PO 1, 3, 6, 7 and 11 PSO 1,2, 3, 4	Concept of cooking of food along with different types of cooking and also discuss about pasteurization process in detail.	SOs 1-5	LI 1-2	Baking: Principles, baked foods, baking equipment; Roasting: Principles of roasting, roasting equipment; Frying: theory and principles, shallow or contact frying and deep fat frying, heat and mass transfer in frying, frying equipment; Puffing: Puffing methods, puffing equipment; Pasteurization: Purpose, microorganisms and their reaction to temperature and other influences, methods of heating, design and mode of operation of heating equipment, vat, tubular heat exchanger, plate heat exchanger.	
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	Different types of thermal heat treatment in food such as sterilization, blanching and canning etc.	SOs 1-5	LI 1-2	Sterilization: Principles, process time, T-evaluation, design of batch and continuous sterilization, different methods and equipments; UHT sterilization, in the package sterilization, temperature and pressure patterns, equipment for sterilizing goods in the package; Blanching: principle and equipment.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT424
Course Title :	Food Biotechnology
Pre- requisite:	Students should have basic knowledge of elementary biology microbiology and Food Chemistry.
Rationale:	Food biotechnology utilizes advanced genetic tools to identify and emphasize the necessary and desired characteristics of animals, plants microorganisms, and other organisms for the purpose of food production. It primarily involves the removal or insertion of genes to attain desired characteristics. The advancement of agricultural practices involves the utilization of traditional techniques such as Fermentation, Cross Breeding, Crop Rotation, and Cover cropping. There is no documented evidence of any detrimental effects.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT424.1	Understanding the basic modules of Microbial genetics, mechanism of replication and transformation.
54FT424.2	Explain the basics genetic systems of bacteria, bacteriophage and plasmids.
54FT424.3	Acquired the knowledge for Recombinant DNA technology.
54FT424.4	Explain the role of microorganisms in Genetic Engineering.
54FT424.5	Demonstrate practical skills in modifying the plants with Recombinant techniques.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT424	Food Biotechnology	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 424	Food Biotechnology	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT424.1:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand Chemical trait of the genetic material SO1.2 Understand Organization of the genetic material SO1.3 Understanding the DNA replication process SO1.4 Understanding the DNA replication mechanism SO1.5 Understanding the Process of Protein formation.	1.1. Study of auxotroph; 1.2. Micro-propagation through tissue culture	1.1 Chemical nature of the genetic material 1.2 Properties and functions of the genetic material 1.3 Organization of the genetic material in bacteria 1.4 Eukaryotes and viruses 1.5 DNA replication: Replication fork, DNA polymerases, other enzymes. Proteins required for DNA replication 1.6 Origin of replication, replication of circular DNA molecule; Transcription and translation	1.1 Knowledge about ATP structure and functions

SW-1 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT424.2:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand synthesis of RNA and its type SO2.2 Understand Mutation and DNA repair SO2.3 Understanding Transposable elements, plasmids SO2.4 Understanding Genetic recombination in bacteria SO2.5 Understanding Regulation of gene expression in bacteria.	2.1. Strain improvement through U.V. mutation for lactose utilization 2.2. Chemical mutagenesis using chemical mutagens (Ethidium bromide)	2.1 RNA synthesis 2.2 Types of RNA, genetic code; 2.3 Mutation and DNA repair, mechanisms of repair of damaged DNA 2.4 Photo reactivation, excision repair, recombination repair, SOS repair, mismatch repair 2.5 Transposable elements, plasmids, types of plasmids 2.6 Genetic recombination in bacteria, transformation, transduction, conjugation Regulation of gene expression in prokaryotes; Expression of foreign genes; Promoter enzymes	2.1 Knowledge about RNA structures

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT424.3:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand Recombinant DNA technology SO3.2 Understand Vectors SO3.3 Understanding PCR and its Mechanism SO3.4 Understanding Construction of recombined DNA SO3.5 Understanding Identification and selection of cells	3.1. Determination of survival curves using physical and chemical mutagens 3.2. Isolation and analysis of chromosomal/genomic DNA from *E. coli* and *Bacillus cereus*	3.1. Recombinant DNA technology: Restriction enzymes, 3.2. Cloning vectors, cloning procedure, cloning of specific gene and their identification (colony hybridization, C-DNA, southern blotting, 3.3. Polymerase chain reaction); Gene cloning: Production of identical cells, isolation and purification of insert DNA, 3.4 Isolation of vector DNA. 3.5 Construction of recombined DNA, introduction of recombined DNA into host cell 3.6 Identification and selection of cells containing cloned genes	3.1 Knowledge about thermal cycler

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT424.4

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand Biosensors SO4.2 Understand Application of biotechnology in food SO4.3 Understanding Methods of immobilization SO4.4 Understanding Physical Methods of immobilization SO4.5 Understanding Large scale cell immobilization.	4.1. Separation of protoplast using cellulytic enzymes 4.2. Production of biomass from fruit and vegetable waste	4.1 Biosensors: Classification, application in food industry; 4.2 Application of biotechnology in food: Immobilization of enzymes: 4.3 Arresting of cell in insoluble matrix, immobilized cell systems, cell attachment in a surface, aggregation, entrapment, containment 4.4 Physical adsorption, covalent bonding, cross linking, entrapment into polymeric films, microencapsulation 4.5 Large scale cell immobilization, 4.6 Uses and applications in industries	4.1 Knowledge about Biochips and Scale up immobilization.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT424.5:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand Ethical issues in GM Crops SO5.2 Understand Testing of GM Crops SO5.3 Understanding Effect of GM Crops SO5.4 Understanding Risk of GM Crops SO5.5 Understanding Acceptance of GM Crops	5.1. Introduction of ELISA/Southern blot/DNA finger printing, etc 5.2. Agarose gel electrophoresis of plasmid DNA	5.1 Ethical issues concerning GM foods 5.2 Testing for GMOs, current guidelines for production 5.3 Release and movement of GMOs, labeling and traceability 5.4 Trade related aspects, bio-safety, risk assessment, risk management, 5.5 Public perception of GM foods, IPR 5.6 GMO Act 2004	5.1 Knowledge about GM Crops and Case study

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT424.1: Understanding the basic modules of Microbial genetics, mechanism of replication and transformation	6	4	1	1	12
54FT424.2: Explain the basic genetic systems of bacteria, bacteriophage and plasmids	6	4	1	1	12
54FT424.3: Acquired the knowledge for Recombinant DNA technology.	6	4	1	1	12
54FT424.4 Explain the role of microorganisms in Genetic Engineering	6	4	1	1	12
54FT424.5: Demonstrate practical skills in modifying the plants with Recombinant techniques.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Mechanism of Protein Formation	5	3	2	10
CO-2	Plasmid and Vectors	2	3	5	10
CO-3	Recombinant DNA technology	2	3	5	10
CO-4	Biosensors and Immobilization	2	3	5	10
CO-5	GM Plants	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Biotechnology will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Biotechnology - Expanding Horizons	B.D. Singh	Kalyani Publishers, New Delhi	2014
2	Biotechnology and Food Processing Mechanics	Meenakshi Paul	Gene-Tech Books, New Delhi	2007
3	Molecular Biology of the Gene	James D. Watson	Benjamin Cummings, San Francisco, USA	2013, 7th Ed

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT424
Course Title: Food Biotechnology

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Understanding the basic modules of Microbial genetics, mechanism of replication and transformation	2	2	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Explain	2	2	1	1	2	1	3	1	2	1	1	3	3	3	3	3

the basic genetic systems of bacteria, bacteriophage and plasmids																
CO3: Acquired the knowledge for Recombinant DNA technology.	2	2	3	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Explain the role of microorganisms in Genetic Engineering	2	2	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Demonstrate practical skills in modifying the plants with Recombinant techniques.	2	3	3	1	1	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

POs & PSOs	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 8 and,10 PSO 1,2, 3, 4	CO1: Understanding the basic modules of Microbial genetics, mechanism of replication and transformation	SOs 1-5	LI 1-2	Chemical nature of the genetic material, properties and functions of the genetic material, organization of the genetic material in bacteria, eukaryotes and viruses; DNA replication: Replication fork, DNA polymerases, other enzymes and proteins required for DNA replication, origin of replication, replication of circular DNA molecule; Transcription and translation.	**As mentioned in page number 3 to 7**
PO 2,7 and 12 PSO 1,2, 3, 4	CO2: Explain the basic genetic systems of bacteria, bacteriophage and plasmids	SOs 1-5	LI 1-2	RNA synthesis, types of RNA, genetic code; Mutation and DNA repair, mechanisms of repair of damaged DNA (photo reactivation, excision repair, recombination repair, SOS repair, mismatch repair), transposable elements, plasmids, types of plasmids, genetic recombination in bacteria, transformation, transduction, conjugation, regulation of gene expression in prokaryotes; Expression of foreign genes; Promoter enzymes	
PO 2 and 5 PSO 1,2, 3, 4	CO3: Acquired the knowledge for Recombinant DNA technology.	SOs 1-5	LI 1-2	Recombinant DNA technology: Restriction enzymes, cloning vectors, cloning procedure, cloning of specific gene and their identification (colony hybridization, C-DNA, southern blotting, polymerase chain reaction); Gene cloning: Production of identical cells, isolation and purification of insert DNA, isolation of vector DNA, construction of recombined DNA, introduction of recombined DNA into host cell, identification and selection of cells containing cloned genes	
PO 2, 5, 7, 11 and 12 PSO 1,2, 3, 4	CO4: Explain the role of microorganisms in Genetic Engineering	SOs 1-5	LI 1-2	Biosensors: Classification, application in food industry; Application of biotechnology in food: Immobilization of enzymes: Arresting of cell in insoluble matrix, immobilized cell systems, cell attachment in a surface, aggregation, entrapment, containment, physical adsorption, covalent bonding, cross linking, entrapment into polymeric films, microencapsulation, large scale cell immobilization, uses and applications in industries.	
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	CO5: Demonstrate practical skills in modifying the plants with Recombinant techniques.	SOs 1-5	LI 1-2	Ethical issues concerning GM foods: Testing for GMOs, current guidelines for production, release and movement of GMOs, labeling and traceability, trade related aspects, bio-safety, risk assessment, risk management, public perception of GM foods, IPR, GMO Act 2004	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT425
Course Title :	Food Refrigeration and Cold Chain
Pre- requisite:	Students should have basic knowledge in thermodynamics, heat transfer, and fluid mechanics, along with familiarity with HVAC concepts, psychometric, and refrigeration cycles."
Rationale:	Refrigeration and air conditioning ensure comfort, preserve perishables, and maintain industrial processes by controlling temperature, humidity, and air quality for various applications and environments."

Course Outcomes (CO):

Course Code	Course Outcomes
54FT425.1	Fundamentals of thermodynamics, refrigerating capacity, and coefficient of performance in refrigeration systems.
54FT425.2	Analysis of air and vapor refrigeration cycles, selection of operating temperatures, and system efficiencies.
54FT425.3	Interpretation of vapor compression cycles, including diagrams, superheating, subcooling, and system optimization.
54FT425.4	Operations of ice production, cold storage design, refrigerated transport logistics, and system security and efficiency.
54FT425.5	Factors affecting comfort, design and operation of air-conditioning systems, and load calculations for cooling requirements.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT425	Food Refrigeration and Cold Chain	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 425	Food Refrigeration and Cold Chain	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT425.1: Fundamentals of thermodynamics, refrigerating capacity, and coefficient of performance in refrigeration systems.

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Define refrigeration and its importance in heat transfer. SO1.2 Analyze factors influencing COP and methods to improve system efficiency. SO1.3 Evaluate thermoelectric cooling, adiabatic demagnetization, and their roles in achieving ultra-low temperatures for specialized applications.	1.1. Study of vapour compression refrigeration system 1.2.Determination of COP of vapour compression refrigeration system	1.1. Principles of refrigeration: Definition, background with second law of thermodynamics 1.2. unit of refrigerating capacity, coefficient of performance 1.3. Production of low temperatures: Expansion of a liquid with flashing 1.4. reversible/ irreversible adiabatic expansion of a gas/ real gas 1.5. thermoelectric cooling 1.6. adiabatic demagnetization	1.1 Compare and contrast different methods for producing low temperatures.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the role of the Second Law of Thermodynamics in refrigeration processes.
2. Discuss the coefficient of performance (COP) and its significance in evaluating refrigeration efficiency.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT425.2: Analysis of air and vapor refrigeration cycles, selection of operating temperatures, and system efficiencies.

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Evaluate the application of vapor in refrigeration systems, considering p-V and T-s diagrams and practical limitations. SO2.2 Define the reversed Brayton (Bell Coleman) cycle and its role in air refrigeration. SO2.3 Apply theoretical knowledge to analyze and optimize refrigeration cycles and systems.	2.1. Study of various types of condensers, expansion valves and evaporative coils used in refrigeration systems 2.2. Study of direct and indirect contact freezing equipment for foods	2.1. Air refrigerators working on reverse Carnot cycle 2.2. selection of operating temperatures; Air refrigerators working on Bell Coleman cycle 2.3. , analysis of gas cycle, polytropic and multistage compression; Vapour refrigeration: Vapor as a refrigerant in reversed Carnot cycle with p-V and T-s diagrams 2.4. limitations of reversed Carnot cycle 2.5. Modifications in reverse Carnot cycle with vapour as a refrigerant 2.6. dry Vs wet compression, throttling Vs isentropic expansion	2.1 Compare different compression methods (dry vs. wet, throttling vs. isentropic) in vapour compression systems for efficiency and performance.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Formulate recommendations for improving efficiency and performance of refrigeration systems based on cycle selection and operational parameters.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT425.3: Interpretation of vapor compression cycles, including diagrams, superheating, subcooling, and system optimization.

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Identify and explain the roles of components (evaporator, compressor, condenser, expansion valve) in a vapor compression refrigeration system. SO3.2 Illustrate the vapor compression cycle on a pressure-enthalpy diagram, emphasizing superheating and subcooling stages. SO3.3 Classify common refrigerants based on their physical, chemical, safety, thermodynamic, and economic properties, including azeotropes.	3.1. Study of refrigerants, their properties and charts 3.2. Study of deep freezing and thawing of foods	3.1. representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling 3.2.Liquid-vapour regenerative heat exchanger for vapour compression system 3.3. effect of suction vapour super heating and liquid sub cooling, actual vapour compression cycle 3.4. Vapour-absorption refrigeration system: Process, calculations, maximum coefficient of performance of a heat operated refrigerating machine 3.5. Common refrigerants and their properties: classification, nomenclature, desirable properties of refrigerants-physical, chemical, safety, thermodynamic and economical; Azeotropes 3.6 Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve	3.1 Describe the process and calculations involved in vapor-absorption refrigeration systems.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the effects of suction vapor superheat and liquid subcooling on system efficiency and performance.
2. Analyze the actual vapor compression cycle, considering practical deviations and improvements.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT425.4 Operations of ice production, cold storage design, refrigerated transport logistics, and system security and efficiency.

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Analyze insulation techniques, vapor barriers, and flooring solutions to prevent frost-heave and maintain temperature stability. SO4.2 Explain principles and systems used in ice production, including brine and freezing tanks. SO4.3. Outline handling and distribution practices in the cold chain to maintain product integrity.	4.1. Study of food cold storage; Estimation of refrigeration load for cold storage 4.2. Estimation of refrigeration load for ice-cream	4.1. Ice manufacture, principles and systems of ice production, Treatment of water for making ice 4.2. brines, freezing tanks, ice cans, air agitation, quality of ice 4.3. Cold store, design of cold storage for different categories of food resources, size and shape, construction and material 4.4. insulation, vapour barriers, floors, frost-heave, interior finish and fitting, evaporators, automated cold stores, security of operations 4.5. Refrigerated transport: Handling and distribution 4.6. cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display	4.1 Discuss order picking strategies and operational security measures to ensure product safety and quality throughout transport and display.

SW-4 Suggested Sessional Work (SW):
Assignments:
1. Design cold storage facilities tailored for different food categories, considering size, shape, and construction materials.
2. Describe refrigerated transport methods, including refrigerated vans and displays.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT425.5: Factors affecting comfort, design and operation of air-conditioning systems, and load calculations for cooling requirements.

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Identify factors influencing comfort air-conditioning, including temperature, humidity, air movement, and air quality. SO5.2 Analyze physiological principles influencing human comfort and the design considerations for air distribution and duct systems. SO5.3 Perform cooling load calculations considering various sources such as product cooling, conducted heat, and internal heat gains.	5.1 Estimation of refrigeration load for meat and poultry products 5.2 Estimation of refrigeration load during chocolate enrobing process	5.1. Air-conditioning: Meaning, factors affecting comfort air-conditioning, classification, sensible heat factor 5.2. industrial air-conditioning, problems on sensible heat factor; Winter/summer/year round air-conditioning 5.3. unitary air-conditioning systems, central air-conditioning, physiological principles in air-conditioning 5.4. air distribution and duct design methods 5.5. design of complete air-conditioning systems; humidifiers and dehumidifiers 5.6. Cooling load calculations: Load sources, product cooling, conducted heat, convected heat, internal heat sources, heat of respiration, peak load	5.1 Compare and contrast unitary vs. central air-conditioning systems. .

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Classify air-conditioning systems based on function and application, distinguishing between sensible heat factor and industrial requirements.
2. Discuss the design methodology for complete air-conditioning systems, including the selection of humidifiers, dehumidifiers, and other components to meet comfort and operational requirements.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT425.1: Fundamentals of thermodynamics, refrigerating capacity, and coefficient of performance in refrigeration systems.	6	4	1	1	12
54FT425.2: Analysis of air and vapor refrigeration cycles, selection of operating temperatures, and system efficiencies.	6	4	1	1	12
54FT425.3: Interpretation of vapor compression cycles, including diagrams, superheating, subcooling, and system optimization.	6	4	1	1	12
54FT425.4: Operations of ice production, cold storage design, refrigerated transport logistics, and system security and efficiency.	6	4	1	1	12
54FT425.5: Factors affecting comfort, design and operation of air-conditioning systems, and load calculations for cooling requirements.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Basic of Refrigeration and Thermodynamics	5	3	2	10
CO-2	Reversed Carnot cycle, Vapour Compression System	2	3	5	10
CO-3	Vapour Absorption System , Refrigerants	2	3	5	10
CO-4	Ice Plant, Cold Storge and Refrigerated Transport	2	3	5	10
CO-5	Air conditioning , Cooling Load Calculation	3	2	5	10
Total		14	14	22	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Refrigeration and Cold Chain will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Refrigeration & Air Conditioning Technology	William C. Whitman, William M. Johnson, John A. Tomczyk and Eugene Silberstein	Delmar, Cengage Learning, NY, USA	6th Ed. ,2009
2	Refrigeration and Air Conditioning	C.P. Arora	Tata McGraw-Hill Publishing Co. Ltd., New Delhi	2nd Ed. ,2000
3	Refrigeration and Air Conditioning	W.F. Stoecker and J.W. Jones	McGraw-Hill Book Co., New York, USA	2nd Ed , 1982

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT425
Course Title: Food Refrigeration and Cold Chain

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1: Fundamentals of thermodynamics, refrigerating capacity, and coefficient of performance in refrigeration systems.	3	1	1	1	1	1	1	3	1	3	1	1	2	3	2	1
CO2: Analysis of air and vapor refrigeration cycles, selection of operating temperatures, and system efficiencies.	2	2	1	1	2	1	3	1	2	1	1	3	3	2	2	2
CO3: Interpretation of vapor compression cycles, including diagrams, superheating, subcooling, and system optimization.	3	2	2	1	3	1	1	1	2	2	1	3	3	2	2	2
CO4: Operations of ice	3	1	1	1	3	1	3	1	2	3	1	3	2	2	2	1

production, cold storage design, refrigerated transport logistics, and system security and efficiency.																
CO5: Factors affecting comfort, design and operation of air-conditioning systems, and load calculations for cooling requirements.	2	3	3	1	1	1	3	3	2	2	1	3	3	3	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

POs & PSOs	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 8 and,10 PSO 1,2, 3, 4	CO1: Fundamentals of thermodynamics, refrigerating capacity, and coefficient of performance in refrigeration systems.	SOs 1-3	LI 1-2	Principles of refrigeration: Definition, background with second law of thermodynamics,, unit of refrigerating capacity, coefficient of performance; Production of low temperatures: Expansion of a liquid with flashing, reversible/ irreversible adiabatic expansion of a gas/ real gas, thermoelectric cooling, adiabatic demagnetization.	**As mentioned in page number 3 to 7**
PO 2,7 and 12 PSO 1,2, 3, 4	CO2: Analysis of air and vapor refrigeration cycles, selection of operating temperatures, and system efficiencies.	SOs 1-3	LI 1-2	Air refrigerators working on reverse Carnot cycle: Carnot cycle, reversed Carnot cycle, selection of operating temperatures; Air refrigerators working on Bell Coleman cycle: Reversed Brayton or Joule or Bell Coleman cycle, analysis of gas cycle, polytropic and multistage compression; Vapour refrigeration: Vapor as a refrigerant in reversed Carnot cycle with p-V and T-s diagrams, limitations of reversed Carnot cycle; Vapour compression system: Modifications in reverse Carnot cycle with vapour as a refrigerant.	
PO 2 and 5 PSO 1,2, 3, 4	CO3: Interpretation of vapor compression cycles, including diagrams, superheating, subcooling, and system optimization.	SOs 1-3	LI 1-2	representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling; Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heat and liquid sub cooling, actual vapour compression cycle; Vapour-absorption refrigeration system: Process, calculations, maximum coefficient of performance of a heat operated refrigerating machine, Common refrigerants and their properties: classification, nomenclature, desirable properties of refrigerantsphysical, chemical, safety, thermodynamic and economical; Azeotropes; Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve.	
PO 2, 5, 7, 11 and 12 PSO 1,2, 3, 4	CO4: Operations of ice production, cold storage design, refrigerated transport logistics, and system security and efficiency.	SOs 1-3	LI 1-2	Ice manufacture, principles and systems of ice production, Treatment of water for making ice, brines, freezing tanks, ice cans, air agitation, quality of ice; Cold storage: Cold store, design of cold storage for different categories of food resources, size and shape, construction and material, insulation, vapour barriers, floors, frost-heave, interior finish and fitting, evaporators, automated cold stores, security of operations; Refrigerated transport: Handling and distribution, cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display	
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	CO5: Factors affecting comfort, design and operation of air-conditioning systems, and load calculations for cooling requirements.	SOs 1-3	LI 1-2	Air-conditioning: Meaning, factors affecting comfort air-conditioning, classification, sensible heat factor, industrial air-conditioning, problems on sensible heat factor; Winter/summer/year round air-conditioning, unitary air-conditioning systems, central air-conditioning, physiological principles in air-conditioning, air distribution and duct design methods; design of complete air-conditioning systems; humidifiers and dehumidifiers; Cooling load calculations: Load sources, product cooling, conducted heat, convected heat, internal heat sources, heat of respiration, peak load; etc	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT426
Course Title :	Processing of Spices and Plantation Crops
Pre- requisite:	Students should have basic knowledge of various processing of Spices and Plantation Crops
Rationale:	The students studying Food Technology should possess foundational understanding about production and processing scenario of spice, flavour and plantation crops including of major and minor spices and post harvest technology for tea, coffee, cocoa, vanilla and annatto processing and extraction techniques, standard specification of spices, functional packaging of spices and spice products and utilization of various byproducts of plantation crops and spices

Course Outcomes (CO):

Course Code	Course Outcomes
54FT426.1	Understand the knowledge of production and processing scenario of spice, flavor and plantation crops and its scope..
54FT426.2	Acquired the knowledge of Post harvest technology, composition, processed products of major spices.
54FT426.3	Acquired the knowledge processing and utilization of all minor spices.
54FT426.4	Understand the knowledge of post harvest technology for tea, coffee, cocoa, vanilla and annatto processing.
54FT426.5	Apply the knowledge of the extraction techniques, functional packaging and utilization of various byproducts of spice and plantation crops.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT426	Processing of Spices and Plantation Crops	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 426	Processing of Spices and Plantation Crops	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT426.1:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand Production of spice. **SO1.2** Understand about processing scenario of spice. **SO1.3** Flavour of spice. and plantation crops. **SO1.4** Plantation crops. **SO1.5** Scope of spice and plantation crops.	**1.1** Identification and characterizati on of flavouring compounds of spices. **1.2** Valuable oil determination.	1.1 Production and processing scenario of spice **1.2** Flavour and plantation crops and its scope: **1.3** Basic definition of Spices and Plantation crops. **1.4** Current status of major and minor spices and plantation crops. **1.5** Further scope of spice **1.6** plantation crops.	**1.1** Knowledge about various major and minor spices and plantation crops in India.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT426.2:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 To Understand post harvest technology of various major spices. **SO2.2** To Understand about composition of various major spices. **SO2.3** To understand processed products of the major spices. **SO2.4** To understand the processing costs of various processed major spice products. **SO2.5** To learn processing losses in spice industry.	**2.1** Extraction of oil from clove and pepper. **2.2** Extraction of oil from cardamom.	2.1 Raw ingredients used in manufacturing of major spice based processed products: **2.2** Types of raw materials in manufacturing of various major spice based processed products. **2.3** Composition of various major spice based processed products. **2.4** Distribution of various major spice based processed products. **2.5** Requirement of various major spice based processed products. **2.6** Types of food additives used in manufacturing of various major spice based processed products.	**2.1** Knowing about various raw ingredients used in manufacturing in major spices based processed products.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT426.3:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 To Understand post harvest technology of various minor spices. **SO3.2** To Understand about composition of various minor spices. **SO3.3** To understand processed products of the minor spices. **SO3.4** To understand the processing costs of various processed minor spice products. **SO3.5** To learn processing losses in spice industry.	**3.1** Extraction of oleoresins. **3.2** Peperine estimation in pepper.	3.1 Raw ingredients used in manufacturing of minor spice based processed products: **3.2** Types of raw materials in manufacturing of various minor spice based processed products. **3.3** Composition of various minor spice based processed products. **3.4** Distribution of various minor spice based processed products. **3.5** Requirement of various minor spice based processed products. **3.6** Types of food additives used in manufacturing of various minor spices based processed products.	**3.1** Knowing about various raw ingredients used in manufacturing in minor spices based processed products.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT426.4

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding the post harvest technology for Tea processing. **SO4.2** Understanding the post harvest technology for coffee processing. **SO4.3** Understanding the post harvest technology for cocoa processing. **SO4.4** Understanding the post harvest technology for Vanilla processing. **SO4.**5 Understanding the post harvest technology for annatto processing.	**4.1** Steam distillation of spices. **4.2** Determination of curcumin content in turmeric	**4.1** Post harvest technology for Tea, coffee, cocoa; Vanilla and annatto processing: **4.2** Various post harvest technologies for spice and plantation crops. **4.3** Analysis of post harvest losses in various spice and plantation crops in India. **4.4** Brief about facing problems during processing of processed spice products. **4.5** Unit Operations and Equipment used 4.6 post harvest technology for various spice and plantation crops.	**4.1** Preparation of process flow manufacturing of various spice and plantation crops.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT426.5:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Post harvest technology and processing of areca nut, cashew nut, oil palm. **SO5.2** Knowledge about flavours of major and minor spices. **SO5.3** Extraction techniques and Standard specification of spices. **SO5.4** Functional packaging of spices and spice products. **SO5.**5 By-products of plantation crops and spices.	**5.1** Chemical analysis of spices. **5.2** Study of standard specification of spices.	**5.1** Extraction techniques, standard specification of spices, functional packaging of spices and spice products 5.2 Otilization of various byproducts of plantation crops and spices: **5.3** Post harvest technology and processing of various spice products. **5.4** Overview on various extraction techniques used in processed spice products. **5.5** Functional packaging and its application in spice industry. **5.6** Application of various by-products of spice and plantation crops.	**5.1** Application of various packaging technology in spice industry in India.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT426.1: Understand the knowledge of production and processing scenario of spice, flavour and plantation crops and its scope.	6	4	1	1	12
54FT426.2: Acquired the knowledge of Post harvest technology, composition, processed products of major spices.	6	4	1	1	12
54FT426.3: Acquired the knowledge processing and utilization of all minor spices.	6	4	1	1	12
54FT426.4: Understand the knowledge of post harvest technology for tea, coffee, cocoa, vanilla and annatto processing.	6	4	1	1	12
54FT426.5: Apply the knowledge of the extraction techniques, functional packaging and utilization of various byproducts of spice and plantation crops.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Production and processing scenario of spice, flavour and plantation crops and its scope.	3	3	2	10
CO-2	Major spices including with Post harvest technology, composition, processed products of spices.	3	3	5	10
CO-3	Minor spices including with processing and utilization.	3	3	5	10
CO-4	Post harvest technology for tea, coffee, cocoa, vanilla and annatto processing.	2	3	5	10
CO-5	Extraction techniques, functional packaging and utilization of various byproducts of spice and plantation crops.	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing of Spice and Plantation Crops will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Spices and Plantation Crops	K.G. Shanmugavelu	Oxford & IBH Publishing Co., New Delhi	1st edition, 1979
2	Spices- Vol. I and II	J.W. Purseglave, E.G. Brown	SRJ Academic Press, New Delhi	1986
3	Spices and Condiments- Major Spices of India	J.S. Pruthi	National Book Trust, New Delhi	2001
4	Spices and Condiments- Minor Spices of India	J.S. Pruthi	National Book Trust, New Delhi	2001

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)

Course Code: 54FT426

Course Title: Processing of Spices and Plantation Crops

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modem tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO 1: Understand the knowledge of production and processing scenario of spice, flavour and plantation crops and its scope.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO 2: Acquired the knowledge of Post harvest technology,	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

composition, processed products of major spices.																
CO 3: Acquired the knowledge processing and utilization of all minor spices.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO 4: Understand the knowledge of post harvest technology for tea, coffee, cocoa, vanilla and annatto processing.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO 5: Apply the knowledge of the extraction techniques, functional packaging and utilization of various byproducts of spice and plantation crops	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO 1: Understand the knowledge of production and processing scenario of spice, flavour and plantation crops and its scope.	**SOs 1-5**	2	Unit-1: Production and processing scenario of spice, flavour and plantation crops and its scope.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO 2: Acquired the knowledge of Post harvest technology, composition, processed products of major spices.	**SOs 1-5**	2	Unit-2: Major spices including with Post harvest technology, composition, processed products of spices.	
PO 1 to 12 and PSO 1 to 4	CO 3: Acquired the knowledge processing and utilization of all minor spices.	**SOs 1-5**	2	Unit-3: Minor spices including with processing and utilization.	
PO 1 to 12 and PSO 1 to 4	CO 4: Understand the knowledge of post harvest technology for tea, coffee, cocoa, vanilla and annatto processing.	**SOs 1-5**	2	Unit-4: Post harvest technology for tea, coffee, cocoa, vanilla and annatto processing.	
PO 1 to 12 and PSO 1 to 4	CO 5: Apply the knowledge of the extraction techniques, functional packaging and utilization of various byproducts of spice and plantation crops	**SOs 1-5**	2	Unit-5: Extraction techniques, functional packaging and utilization of various byproducts of spice and plantation crops.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT477
Course Title :	Skill Development (Cereals and Pulses Processing)- Lab
Pre- requisite:	Students should have basic knowledge of cereals and pulses including with different types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing of various cereals and pulses products. They have to develop employability skills, intellectual skills, core of key skills and personal attributes with full responsibility and self-confidence.
Rationale:	The students studying Food Technology should possess foundational understanding about cereals and pulses including with their processing, packaging and storage conditions.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT477.1	Ability to develop employability skills in the field of cereals and pulses.
54FT477.2	Ability to enhance technical knowledge and skills in the field of cereals and pulses.
54FT477.3	Ability to assess the quality of cereals and pulses products.
54FT477.4	Ability to recall the standards and regulations of cereals and pulses industries.
54FT477.5	Ability to demonstrate skills in cereals and pulses industries.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT477	Skill Development (Cereals and Pulses Processing)- Lab	0	4	0	0	0	2

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e.

Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in Laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.
Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment (Practical):

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		End Semester Practical Exam (ESPE) (Viva-Voce+Record)
			Viva-Voce	Record	
PCFT	54FT477	Skill Development (Cereals and Pulses Processing)- Lab	60	40	100

Course-Curriculum Detailing:
This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment
The end of semester assessment, the student will be required to prepare a detailed Project Report on Skill Development (Cereals and Pulses Processing). The internal assessment will be carried out by the internal faculties.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

- Making Project Report and Power Point Presentation on the same skill.
- Take guidance of concerned teacher that assigned for the same subject.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT477
Course Title: Food Refrigeration and Cold Chain

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO 1: Ability to develop employability skills in the field of cereals and pulses.	3	1	1	1	1	1	1	3	1	3	1	1	2	3	2	1
CO 2: Ability to enhance	2	2	1	1	2	1	3	1	2	1	1	3	3	2	2	2

technical knowledge and skills in the field of cereals and pulses.																
CO 3: Ability to assess the quality of cereals and pulses products.	3	2	2	1	3	1	1	1	2	2	1	3	3	2	2	2
CO 4: Ability to recall the standards and regulations of cereals and pulses industries.	3	1	1	1	3	1	3	1	2	3	1	3	2	2	2	1
CO 5: Ability to demonstrate skills in cereals and pulses industries.	2	3	3	1	1	1	3	3	2	2	1	3	3	3	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

AKS University, Satna

Faculty of Agriculture Science & Technology

Department of Agriculture Engineering and Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

POs & PSOs	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	SL
PO 8 and,10 PSO 1,2, 3, 4	CO 1: Ability to develop employability skills in the field of cereals and pulses.	SOs 1-3			As mentioned in page number 3 to 7
PO 2,7 and 12 PSO 1,2, 3, 4	CO 2: Ability to enhance technical knowledge and skills in the field of cereals and pulses.	SOs 1-3			
PO 2 and 5 PSO 1,2, 3, 4	CO 3: Ability to assess the quality of cereals and pulses products.	SOs 1-3			
PO 2, 5, 7, 11 and 12 PSO 1,2, 3, 4	CO 4: Ability to recall the standards and regulations of cereals and pulses industries.	SOs 1-3			
PO 5, 7, 8 and 12 PSO 1,2, 3, 4	CO 5: Ability to demonstrate skills in cereals and pulses industries.	SOs 1-3			

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT526
Course Title :	Bakery, Confectionery and Snack Products
Pre- requisite:	Students should have basic knowledge of different types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing of various Bakery, Confectionery and Snack Products.
Rationale:	The students studying Food Technology should possess foundational understanding about Bakery, Confectionery and chocolate products and Snack food seasonings including with their processing, packaging and storage conditions.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT526.1	Understand the knowledge of processing, equipment, packaging, storage and quality testing of bakery products.
54FT526.2	Acquired the knowledge of processing, equipment, packaging, storage and quality testing of confectionery and chocolate products.
54FT526.3	Analyze the product quality characteristics, defects, causes and corrective measures of confectionery and chocolate products
54FT526.4	Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack foods.
54FT526.5	Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack food seasonings.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT526	Bakery, Confectionery and Snack Products	2	2	1	1	6	3

Legend

- **CI:** Classroom Instructin (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2+ESPA+ESE)
			SA 1	SA 2			
PCFT	54FT526	Bakery, Confectionery and Snack Products	15	15	20	50	100

Course-Curriculum Detailing

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT526.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 Understand about types and specification of various bakery products SO1.2 Understand about composition and ingredients used for manufacturing of various bakery products. SO1.3 Processing and equipments used for manufacturing of various bakery products. SO1.4 Packaging and storage of various bakery products. SO1.5 Quality testing Various bakery products.	1 Identifications and composition of various ingredients for snacks. 2 Identifications and composition of various ingredients for bakery and confectionery products.	1 Different types of bakery products. 2 Current status of various bakery products in India. 3 Composition and ingredients used in various bakery products. 4 Various steps involved in processing of bakery products. 5 Equipment used for bakery manufacture. 6 Estimate various quality parameters in bakery products.	Knowledge about various bakery industries in India.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT526.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand about types and specification of various Confectionery and chocolate products. SO2.2 Understand about composition and ingredients used for manufacturing of various Confectionery and chocolate products. SO2.3 Processing and equipments used for manufacturing of various Confectionery and chocolate products. SO2.4 Packaging and storage of various Confectionery and chocolate products. SO2.5 Quality testing of Various Confectionery and chocolate products.	1 Preparation, packaging and quality evaluation of selected snack items. 2 Preparation, packaging and quality evaluation of selected bakery items.	1. Nucleic acids: Properties, structure and metabolism 2. Vitamins and minerals: Chemistry and metabolic functions; Enzymes 3. Chemical nature and nomenclature, classification, sources and properties, mechanism of action, coenzyme and prosthetic groups 4. Concepts and content of nutrition: metabolic function of nutrients 5. Water and energy balance, water intake and losses 6. Basal metabolism	Knowledge about various structures of DNA

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT526.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand about quality characteristics in various Confectionery and chocolate products. SO3.2 Understand about defects in various Confectionery and chocolate products. SO3.3 Corrective measures of various Confectionery and chocolate products. SO3.4 Packaging and storage of various Confectionery and chocolate products. SO3.5 Quality testing of Various Confectionery and chocolate products.	1 Preparation, packaging and quality evaluation of selected confectionery items. 2 Preparation, packaging and quality evaluation of selected chocolates.	1 Different quality characteristics of Confectionery products. 2 Different quality characteristics of chocolate. 3 Current status of various Confectionery and chocolate products in India. 4 Study about various defects in Confectionery. 5 Study about various defects in chocolate products manufacture. 6 Analyze various causes and corrective measures in Confectionery and chocolate products.	Knowledge about various quality parameters in various confectionery and chocolate products.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT526.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO4.1 Understand about types and specification of various snack foods. SO4.2 Understand about composition and ingredients used for manufacturing of various snack foods. SO4.3 Processing and equipments used for manufacturing of various snack foods. SO4.4 Packaging and storage of various snack foods. SO4.5 Quality testing of Various snack foods.	1 Preparation of traditional Indian confection. 2 Sensory evaluation of Indian confection.	1 Different types of snack foods. 2 Current status of various snack foods in India. 3 Ingredients used for snack products. 4 Various steps involved in processing of snack products. 5 Equipment used for snack foods manufacture. 6 Estimate various quality parameters in snack foods.	Knowledge about various snack food industries in India.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT526.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1 Understand about types and specification of various snack food seasonings. SO5.2 Understand about composition and ingredients used for manufacturing of various snack food seasonings. SO5.3 Processing and equipments used for manufacturing of various snack food seasonings. SO5.4 Packaging and storage of various snack food seasonings. SO5.5 Quality testing of Various snack food seasonings.	1 Visit to bakery and confectionary industry. 2 Visit to snack units.	1 Different types of snack food seasonings. 2 Current status of various snack food seasonings in India. 3 Definition and importance of seasoning. 4 Various steps involved in processing. 5 Equipment used for snack food seasonings. 6 Estimate various quality parameters in snack food seasonings.	Knowledge about various snack food seasonings.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	**Class Instructions (CI)**	**Lab Instructions (LI)**	**Sessional Work (SW)**	**Self Learning (SL)**	**Total Hours (CI+ LI + SW + SL)**
54FT526.1: Understand the knowledge of processing, equipment, packaging, storage and quality testing of bakery products.	6	4	1	1	12
54FT526.2: Acquired the knowledge of processing, equipment, packaging, storage and quality testing of confectionery and chocolate products.	6	4	1	1	12
54FT526.3: Analyze the product quality characteristics, defects, causes and corrective measures of confectionery and chocolate products.	6	4	1	1	12
54FT526.4: Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack foods.	6	4	1	1	12
54FT526.5: Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack food seasonings.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Processing, equipment, packaging, storage and quality testing of various bakery products.	03	02	01	06
CO-2	Processing, equipment, packaging, storage and quality testing of various Confectionery and chocolate products.	03	05	03	11
CO-3	Product quality characteristics, defects, causes and corrective measures of confectionery and chocolate products.	03	05	03	11
CO-4	Processing, equipment, packaging, storage and quality testing of various snack foods.	03	05	03	11
CO-5	Processing, equipment, packaging, storage and quality testing of various snack food seasonings	03	03	05	11
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Bakery, Confectionary and Snacks Products will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	The Complete Technology Book on Bakery Products (Baking Science with Formulation & Production)	NIIR Board of Consultants & Engineers	NIIR, New Delhi	3rd Edition, 2014
2	Chocolates & Confections	Peter P. Grewling	John Wiley & Sons, Inc., Hoboken, New Jersey, USA	2nd Edition, 2013
3	Baking Science & Technology- Vol. II: Formulation & Production	E.J. Pyler and L.A. Gorton	Sosland Publishing Company, Kansas City, MO, USA	4th Edition, 2009
4	Baking Science & Technology- Vol. I: Fundamentals & Ingredients	E.J. Pyler and L.A. Gorton	Sosland Publishing Company, Kansas City, MO, USA	4th Edition, 2008

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT526
Course Title: Bakery, Confectionary and Snack Products

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Understand the knowledge of processing, equipment, packaging, storage and quality testing of bakery products.	3	2	1	1	2	3	3	2	3	3	2	3	3	3	3	3
CO:2 Acquired the knowledge of processing,	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3

equipment, packaging, storage and quality testing of confectionery and chocolate products.																
CO:3 Analyze the product quality characteristics, defects, causes and corrective measures of confectionery and chocolate products	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:4 Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack foods.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:5 Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack food seasonings.	3	2	1	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO 1: Understand the knowledge of processing, equipment, packaging, storage and quality testing of bakery products.	**SOs 1-5**	4	Unit-1: Processing, equipment, packaging, storage and quality testing of various bakery products.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO 2: Acquired the knowledge of processing, equipment, packaging, storage and quality testing of confectionery and chocolate products.	**SOs 1-5**	4	Unit-2: Processing, equipment, packaging, storage and quality testing of various Confectionery and chocolate products	
PO 1 to 12 and PSO 1 to 4	CO 3: Analyze the product quality characteristics, defects, causes and corrective measures of confectionery and chocolate products.	**SOs 1-5**	4	Unit-3: Product quality characteristics, defects, causes and corrective measures of confectionery and chocolate products.	
PO 1 to 12 and PSO 1 to 4	CO 4: Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack foods.	**SOs 1-5**	4	Unit-4: Processing, equipment, packaging, storage and quality testing of various snack foods.	
PO 1 to 12 and PSO 1 to 4	CO 5: Understand the knowledge of processing, equipment, packaging, storage and quality testing of snack food seasonings.	**SOs 1-5**	4	Unit-5: Processing, equipment, packaging, storage and quality testing of various snack food seasonings.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT525
Course Title :	Food Process Equipment and Design
Pre- requisite:	Students should have basic knowledge of overview of designing criteria of different instrument that used in food industry.
Rationale:	The students studying Food Process Equipment and Design i.e. have to focused on the different type of equipment that used in food processing Plant for converting the raw material into eatable form along with change its physical, chemical and biological properties and also there designing attribute on the basis of hypothetical approach.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT525.1	Overview of the different types of the material, material fabrication and their properties that should withstand without any rupture.
54FT525.2	Explain the basic concept of designing analysis of pressure vessel, different types of heat exchanger and designing analysis of evaporator.
54FT525.3	Acquired the knowledge for Design of agitators and separators.
54FT525.4	Explain the concept of Design of freezing equipment and different types of dryer that used in food processing industry.
54FT525.5	Explain about concept of Design of material handling equipments that applicable for convey of grain.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT525	Food Process Equipment Design	2	NIL	1	1	4	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA1	SA2			
PCFT	54FT 525	Food Process Equipment and Design	20	20	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT525.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand the Materials and properties: Materials for fabrication SO1.2 Understand the mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes SO1.3 Understand the Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and SO1.4 Understand the theories of failure, safety factor, temperature effects, radiation effects, effects of SO1.5 Understand the fabrication method, economic considerations		1.1 Materials and properties 1.2 Materials for fabrication 1.3 mechanical properties 1.4 Stresses created due to static and dynamic loads 1.5 Theories of failure 1.6 fabrication method	1. Knowledge about Hookes Law for analysis the modulus of elasticity

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify)

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT525.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understand the Design of pressure and storage vessels: Operating conditions, design conditions and stress SO2.2 Understand the Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories; SO2.3 Understand the Design of heat exchangers: Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort; SO2.4 Understand the Design of evaporators and crystallizers: Design of single effect and multiple effect evaporators and its components; Design of rising film and falling film evaporators and feeding arrangements for evaporators SO2.5 Understand the Design of crystalliser and entrainment separator	.	2.1 Pressure and storage vessels 2.2 design conditions and stress 2.3 Design of shell and its component 2.4 Design of heat exchangers 2.5 Design of evaporators 2.6 Design of crystalliser	1. Knowledge of application of pressure vessels in food industry

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT525.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understand the Design of agitators and separators: SO3.2 Understand the Design of agitators and baffles; SO3.3 Understand the Design of agitation system components and drive for agitation; SO3.4 Understand the Design of centrifuge separator; Design of equipment components, SO3.5 Understand the design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems;		3.1 Design of agitators 3.2 Design of separators 3.3 Design of baffles 3.4 Design of agitation system components 3.5 Design of centrifuge separator 3.6 design of shafts	1. Knowledge of application of agitators and baffles in food industry

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT525.4

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	0	1	1	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understand the Design of freezing equipment: SO4.2 Understand the Design of ice-ream freezers and refrigerated display system; SO4.3 Understand the Design of dryers: Design of tray dryer, tunnel dryer, SO4.4 Understand the fluidized dryer, spray dryer, vacuum dryer, SO4.5 Understand the freeze dryer and microwave dryer		4.1 Design of freezing equipment 4.2 Design of ice-ream freezers 4.3 refrigerated display system 4.4 Design of tray dryer, tunnel dryer 4.5 Understand the fluidized dryer 4.6 freeze dryer and microwave dryer	1. Knowledge about application of dryer that used in food industry

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT525.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understand the Design of conveyors and elevators: Design of belt, chain and screw conveyor, SO5.2 Understand the design of bucket elevator and pneumatic conveyor SO5.3 Understand the Design of extruders: Cold and hot extruder design, design of screw and barrel, design of twin screw extruder; Design of fermenters: SO5.4 Understand the Design of fermenter vessel, design problems; Hazards and safety considerations: SO5.5 Understand the Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices		5.1 Design of conveyors 5.2 bucket elevator and pneumatic conveyor 5.3 Design of extruders 5.4 Design of fermenters 5.5 Hazards and safety considerations 5.6 safety measures, safety measures in equipment design	1. To Understand the knowledge about importance of material handling equipments.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT525.1: Overview of the different types of the material, material fabrication and their properties that should withstand without any rupture.	6	0	1	1	8
54FT525.2: Explain the basic concept of designing analysis of pressure vessel, different types of heat exchanger and designing analysis of evaporator.	6	0	1	1	8
54FT525.3: Acquired the knowledge for Design of agitators and separators	6	0	1	1	8
54FT525.4: Explain the concept of Design of freezing equipment and different types of dryer that used in food processing industry.	6	0	1	1	8
54FT525.5: Explain about concept of Design of material handling equipments that applicable for convey of grain	6	0	1	1	8
Total Hours	30	0	5	5	40

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Overview of Metal and its properties	03	03	01	07
CO-2	Designing consideration of pressure vessel and heat exchanger	03	05	02	10
CO-3	Acquired the knowledge for Design of agitators and separators	02	06	03	11
CO-4	Design of freezing equipment and different types of dryer	03	04	04	11
CO-5	Concept of Design of material handling equipments that applicable for convey of grain.	02	04	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Process Equipment Design will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Introduction to Food Engineering	R. Paul Singh and Dennis R. Heldman.	Elsevier, Amsterdam, The Netherlands.	2014, 5th
2	Unit Operations in Food Engineering	Albert Ibarz and Gustavo V. Barbosa-Cánovas	CRC Press, Boca Raton, FL, USA.	2003, 2nd
3	Handbook of Food Processing Equipment.	George D. Saravacos and Athanasios E. Kostaropoulos	Springer Science+Business Media, New York, USA.	2002, 3rd
4	Handbook of Food Engineering Practice	R. K. Sinnott	Butterworth-Heinemann, Oxford, UK.	1999, 3rd

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT525
Course Title: Food Process Equipment Design

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Overview of the different types of the material, material fabrication and their	3	1	3	1	2	3	2	3	1	3	1	1	3	3	3	3

properties that should withstand without any rupture.																
CO:2 Explain the basic concept of designing analysis of pressure vessel, different types of heat exchanger and designing analysis of evaporator.	3	3	2	1	3	1	3	1	2	1	1	1	3	3	3	3
CO:3 Acquired the knowledge for Design of agitators and separators.	3	3	1	1	3	1	1	1	2	2	1	3	3	2	1	1
CO:4 Explain	3	1	3	1	3	1	3	1	2	3	1	3	1	1	3	1

the concept of Design of freezing equipment and different types of dryer that used in food processing industry.																
CO:5 Explain about concept of Design of material handling equipments that applicable for convey of grain.	3	1	2	1	3	1	2	3	2	2	1	1	3	1	3	1

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Overview of Metal and its properties	**SOs 1-5**	4	Materials and properties: Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes; Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Designing consideration of pressure vessel and heat exchanger	**SOs 1-5**	4	Design of pressure and storage vessels: Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories; Design of heat exchangers: Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort; Design of evaporators and crystallizers: Design of single effect and multiple effect evaporators and its components; Design of rising film and falling film evaporators and feeding arrangements for evaporators; Design of crystalliser and entrainment separator;	
PO 1 to 12 and PSO 1 to 4	CO3: Acquired the knowledge for Design of agitators and separators	**SOs 1-5**	4	Design of agitators and separators: Design of agitators and baffles; Design of agitation system components and drive for agitation; Design of centrifuge separator; Design of equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems;	
PO 1 to 12 and PSO 1 to 4	CO4: Design of freezing equipment and different types of dryer	**SOs 1-5**	4	Design of freezing equipment: Design of ice-ream freezers and refrigerated display system; Design of dryers: Design of tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer;	
PO 1 to 12 and PSO 1 to 4	CO5: Concept of Design of material handling equipments that applicable for convey of grain	**SOs 1-5**	4	Design of conveyors and elevators: Design of belt, chain and screw conveyor, design of bucket elevator and pneumatic conveyor; Design of extruders: Cold and hot extruder design, design of screw and barrel, design of twin screw extruder; Design of fermenters: Design of fermenter vessel, design problems; Hazards and safety considerations: Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT524
Course Title :	ICT Applications in Food Industry
Pre- requisite:	A pragmatist approach would allow all stakeholders to create the sets of rights through never-ending dialogue, but this does not seem to be the path followed. There also needs to be agreement on the prerequisites before ICT rights can be addressed. Introduction ICT are tools used for various purposes, among the most prevalent, for communication, technology driven applications in food industry.
Rationale:	Information communication technology-A well-designed technology solution can be used to disseminate resources, connect students to information, enhance teachers' practices and students' performance in all subject areas, improve school management and support data-driven policymaking, developing quality assurance for sustainable growth in food industry.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT524.1	Acquire the knowledge of the computerization in food industry and SCADA
54FT524.2	Acquire the basic and advances knowledge of internet, and programming in MATLAB
54FT524.3	Acquire the basic of toolboxes useful to food industry and computational food dynamics
54FT524.4	Acquire the basic and advance knowledge of GAMBIT, FLUENT AND LABVIEW Software
54FT524.5	Acquire the basic and advance knowledge of Creating Vis and sub Vis.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT524	ICT Applications in Food industry	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 524	ICT Applications in food industry	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT524.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 understanding computerization in food industry SO1.2 Understanding SCADA hardware, software and protocol SO1.3understanding spreadsheet application SO1.4understanding use of problem solver SO1.5understanding statistical relation in MS excel	1. Introduction to various features in spreadsheet 2. Use of add-ins for correlation and regression	CI1.1 Introduction to computerization in food industry, operating environments and information system for various types of food industries CI1.2. supervisory control and data acquisition(SCADA), SCADA system hardware, firmware, software and protocol CI1.3. landlines, local area network system, modems CI1.4 spreadsheet application: data interpretation CI1.5 solving problems, preparation of charts, use of macro to solve engineering problems CI1.6 use of solver, use of add-ins	Learning computerization in MS excel

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT524.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 understanding FTP, and client server model. SO2.2 understanding MATLAB SO2.3understanding PROBLEM solving SO2.4understanding MATLAB programs, application to simulations SO2.5understanding plotting and model building in MATLAB	2.1.Introduction to MATLAB 2.2 Writing code using MATLAB	2.1understanding Web hosting and web page design, file transfer protocol(FTP) 2.2 Online food process control from centralized server system in processing plant 2.3 use of MATLAB in food industry, computing with MATLAB, 2.4 Script files and editor/debugger, MATLAB help system, Problem solving using MATLAB, debugging MATLAB programs, application to simulations 2.5 plotting and model building in MATLAB,X-Y Plotting functions, subplots and overlay plots, special plot types, interactive plotting in MATLAB 2.6 function discovery, regression, the basic fitting interface, three dimensional plots.	Learning MATLAB

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT524.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 understanding Various toolboxes useful to food industry. SO3.2 understanding curve fitting toolbox, fuzzy logic toolbox SO3.3understanding neural network toolbox SO3.4understanding computational fluid dynamics SO3.5understanding substantial derivative, divergence of velocity	3.1 Image processing tool box 3.2 Solution of problems using Fuzzy Logic Toolbox in MATLAB	3.1 Introduction to toolboxes useful to food industry 3.2 Introduction to curve fitting toolboxes, fuzzy logic toolbox. 3.3 neural network toolbox, image processing tool box, statistical toolbox 3.4 introduction to computational fluid dynamics(CFD),governing equation of fluid dynamics; model of flow 3.5substantial derivative, divergence of velocity. 3.6 Continuity, momentum energy equation physical boundary condition, discreatization ;	LEARN fluid dynamics

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT524.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 understanding Application of CFD in food industry. SO4.2 understanding GAMBIT AND FLUENT software SO4.3understanding Lab-VIEW -Lab-VIEW environments; SO4.4understanding NI-DAQ, Simulated data acquisition, SO4.5understanding Lab-VIEW application: creating VI,	4.1 Introductions to GAMBIT software. 4.2 Introduction to fluent software	4.1 Application of CFD in food industry 4.2introduction to CFD software 4.3 GAMBIT AND FLUENT software 4.4 Lab-VIEW -Lab-VIEW environments; getting data into computer. data acquisition device 4.5 NI-DAQ, Simulated data acquisition, sound card 4.6 front panel/block diagram. Tools bar/tools palette: components of a Lab-VIEW application: creating VI, data flow execution debugging technique, additional help, context help tip for working in Lab-VIEW-:Lab-VIEW	LEARN Lab VIEW

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT524.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1understanding loops, function and sub VIs SO5.2 case structure, select (if statements) File I/O Lab-VIEW results	5.1 creating VI 5.2 Introduction to lab view	5.1 Typical programs; loops, while loops, for loops, 5.2 function and sub VIs types of function, searching the function palette, 5.3 creating custom sub VIs decision making and file I/O 5.4 Case structure, select (if statements) File I/O Lab-VIEW results. 5.5 Display data on front panel, controls and indicators, graphs, and charts, arrays, loop timing, 5.6 signal processing , textual math's, math script	Learn to create VI'S and SUBVI'S

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT524.1 Acquire the knowledge of the computerization in food industry and SCADA	6	4	1	1	12
54FT524.2 Acquire the basic and advances knowledge of internet, and programming in MATLAB	6	4	1	1	12
54FT524.3 Acquire the basic of toolboxes useful to food industry and computational food dynamics	6	4	1	1	12
54FT524.4 Acquire the basic and advance knowledge of GAMBIT, FLUENT AND LABVIEW Software	6	4	1	1	12
54FT524.5 Acquire the basic and advance knowledge of Creating Vis and sub Vis.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Acquire the knowledge of the computerization in food industry and SCADA	2	3	5	10
CO-2	Acquire the basic and advances knowledge of internet, and programming in MATLAB	2	3	5	10
CO-3	Acquire the basic of toolboxes useful to food industry and computational food dynamics	2	3	5	10
CO-4	Acquire the basic and advance knowledge of GAMBIT, FLUENT AND LABVIEW Software	2	3	5	10
CO-5	Acquire the basic and advance knowledge of Creating Vis and sub Vis.	2	3	5	10
Total		10	15	25	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for ICT Applications in Food Industry will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis	R. Paul Singh	Academic Press, London	2014
2	Introduction to MATLAB for Engineers	William J. Palm III	McGraw-Hill Companies, Inc., NY, USA	2011, 3rd Ed
3	Introduction to LabVIEW: 3-Hour Hands-On	National Instruments Corporation	NI, Austin, Texas	2005
4	Practical SCADA for Industry	David Bailey and Edwin Wright	Elsevier, Burlington, MA	2003

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT524
Course Title: ICT Applications in Food Industry

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology	Ability to use the research based innovative knowledge for SDGs
CO:1 Acquire the knowledge of the computerization in food industry and SCADA	3	3	3	2	2	1	1	1	2	1	1	1	2	2	2	2
CO:2 Acquire the basic and advances	3	3	2	2	2	1	1	1	2	2	2	1	3	3	2	2

knowledge of internet, and programming in MATLAB																
CO:3 Acquire the basic of toolboxes useful to food industry and computational food dynamics	3	3	3	2	2	1	1	1	2	2	2	2	3	3	2	2
CO:4 Acquire the basic and advance knowledge of GAMBIT, FLUENT AND LABVIEW Software	3	3	3	2	2	1	1	1	2	2	2	2	3	3	2	2
CO:5 Acquire the basic and advance knowledge of Creating Vis and sub Vis.	3	3	3	2	2	1	1	1	2	2	2	2	3	2	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Acquire the knowledge of the computerization in food industry and SCADA	**SOs 1-5**	5	Importance of computerization in food industry, operating environments and information systems for various types of food industries, Supervisory control and data acquisition (SCADA); SCADA systems hardware, firmware, software and protocols, landlines, local area network systems, modems; Spreadsheet applications: Data interpretation and solving problems, preparation of charts, use of macros to solve engineering problems, use of add-ins, use of solver;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Acquire the basic and advances knowledge of internet, and programming in MATLAB	**SOs 1-5**	2	Web hosting and webpage design; file transfer protocol (FTP), on-line food process control from centralized server system in processing plant; Use of MATLAB in food industry; computing with MATLAB, script files and editor/debugger, MATLAB help system, problem solving methodologies, numeric, cell, arrays, matrix operations, user defined functions, programming using MATLAB; debugging MATLAB programs, applications to simulations; Plotting and model building in MATLAB, X-Y plotting functions, subplots and overlay plots, special plot types, interactive plotting in MATLAB, function discovery, regression, the basic fitting interface, three dimensional plots;	
PO 1 to 12 and PSO 1 to 4	CO3: Acquire the basic of toolboxes useful to food industry and computational food dynamics	**SOs 1-5**	1	Introduction to toolboxes useful to food industry, curve fitting toolbox, fuzzy logic toolbox, neural network toolbox, image processing toolbox, statistical toolbox; Introduction to computational fluid dynamics (CFD), governing equations of fluid dynamics; Models of flow, substantial derivative, divergence of velocity, continuity, momentum and energy equations; Physical boundary conditions, discretization;	
PO 1 to 12 and PSO 1 to 4	CO4: Acquire the basic and advance knowledge of GAMBIT, FLUENT AND LABVIEW Software	**SOs 1-5**	3	Applications of CFD in food and beverage industry; Introduction to CFD software, GAMBIT and FLUENT software; LabVIEW – LabVIEW environment: Getting data into computer, data acquisition devices, NI-DAQ, simulated data acquisition, sound card, front panel/block diagram, toolbar/tools palette; Components of a LabVIEW application: Creating a VI, data Flow execution, debugging techniques, additional help, context help, tips for working in LabVIEW; LabVIEW	
PO 1 to 12 and PSO 1 to 4	CO5: Acquire the basic and advance knowledge of Creating Vis and sub Vis.	**SOs 1-5**	1	Typical programs: Loops, while loop, for loop, functions and sub Vis, types of functions, searching the functions palette, creating custom sub Vis, decision making and file I/O, case structure, select (if statement), file I/O; LabVIEW results: Displaying data on front panel, controls and indicators, graphs and charts, arrays, loop timing, signal processing, textual math, math script.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT577
Course Title :	Industrial Training-I
Pre- requisite:	Students should have their technical knowledge and basic skills of the core field specially from quality and production department of the concerned food industry. They have to develop employability skills, intellectual skills, core of key skills and personal attributes along with increase knowledge about how organization work with full responsibility and self-confidence.
Rationale:	The students studying Food Technology should possess Industrial Training for enhancing their basic technical knowledge and basic skills of the core field especially from quality and production department of the concerned food industry including with gain experiences about various laboratory and managerial skills in the working environment in the same organization. They have to work on their employability, intellectual skills and core of key skills.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT577.1	To expose the students to actual working environment and enhance their knowledge and technical skills.
54FT577.2	To instill the good qualities of integrity, responsibility and self-confidence.
54FT577.3	To enhance technical knowledge from quality and production department.
54FT577.4	To develop employability skills, intellectual skills, core of key skills and personal attributes.
54FT577.5	To develop knowledge about how organizations work.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT577	Industrial Training- I	0	0	0	0	0	5

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		End Semester Practical Exam (ESPE) (Viva-Voce+Record)
			Viva Voce	Record	
PCFT	54FT577	Industrial Training- I	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment

The end of semester assessment for Industrial Training- I will be one month training duration carried out by the students. The students will submit their reports and make a presentation. The internal assessment will be carried out by the internal faculties.

Suggested Instructional/ Implementation Strategies:

1. Visit to industry for completion of Industrial Training- I.
2. Making report and power point presentation after completion Industrial Training- I.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT422
Course Title: Food Biochemistry and Nutrition

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology	Ability to use the research based innovative knowledge for SDGs
CO:1 To expose the students to actual working environment and enhance their knowledge and technical	3	3	3	1	2	3	3	2	3	3	2	3	3	3	3	3

skills.																
CO:2 To instill the good qualities of integrity, responsibility and self-confidence.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:3 To enhance technical knowledge from quality and production department.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:4 To develop employability skills, intellectual skills, core of key skills and personal attributes.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:5 To develop knowledge about how organizations work.	3	3	3	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: To expose the students to actual working environment and enhance their knowledge and technical skills.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO2: To instill the good qualities of integrity, responsibility and self-confidence.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO3: To enhance technical knowledge from quality and production department.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO4: To develop employability skills, intellectual skills, core of key skills and personal attributes.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO5: To develop knowledge about how organizations work.	**SOs 1-5**			

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT522
Course Title :	Processing of Meat and Poultry Products
Pre- requisite:	The processing of meat and poultry products requires strict adherence to quality raw materials, sanitation, hygiene, temperature control, and regulatory compliance to ensure safety and quality. Implementation of HACCP, employee training, proper packaging, and allergen control are crucial for maintaining industry standards.
Rationale:	The processing of meat and poultry products is essential for enhancing safety by mitigating microbiological risks, ensuring compliance with health regulations, and extending shelf life. Additionally, processing allows for the creation of diverse and convenient products to meet consumer preferences, contributing to market competitiveness. Through precision in handling and temperature control, processing maintains product quality and minimizes spoilage. Implementation of quality control measures and labeling enhances transparency, enabling consumers to make informed choices. Overall, the rationale for meat and poultry processing lies in balancing safety, quality, and market demands to deliver reliable and appealing products.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT522.1	Safety Assurance: Demonstrate a comprehensive understanding of safety protocols and regulatory compliance in the processing of meat and poultry, ensuring the production of products free from contaminants and pathogens.
54FT522.2	Quality Control Proficiency: Acquire the skills to implement effective quality control measures throughout the processing chain, ensuring consistent product quality, flavor, and texture.
54FT522.3	Technical Competence: Develop technical expertise in various processing methods, such as curing, smoking, cooking, and packaging, to meet industry standards and consumer expectations.
54FT522.4	HACCP Implementation: Apply Hazard Analysis and Critical Control Points (HACCP) principles to identify, assess, and control potential hazards, thereby enhancing the overall safety and integrity of processed meat and poultry products.
54FT522.5	Innovation and Product Development: Explore and implement innovative processing techniques to diversify product offerings, meeting market demands and consumer preferences while considering sustainability and efficiency in production.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT522	Processing of Meat and Poultry Products	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA1	SA2			
PCFT	54FT 522	Processing of Meat and Poultry Products	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT522.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1: Understanding Meat and Poultry Sources: SO2: Insight into the Indian Meat and Poultry Industry: SO3: Pre-slaughter and Slaughtering Operations Proficiency: SO4: Carcass Evaluation Expertise: SO5. Application of Knowledge:	1. Pre-slaughter operations of meat animals and poultry birds; 2. Slaughtering and dressing of meat animals;	1.1 Sources of meat and poultry 1.2 Importance of meat and poultry; 1.3 Status of Meat and poultry industry in India; 1.4 Pre-slaughter operations 1.5 Slaughtering operations for animals and poultry; 1.6 Evaluation of animal carcasses;	Market Analysis and Industry Reports: Online Courses and Tutorials

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT522.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO1: Understanding Post-mortem Changes SO2: Proficiency in Mechanical Deboning and Grading SO3: Aging and Its Impact on Meat Quality SO4: Evaluation of Eating and Cooking Quality SO5: Preservation Techniques Mastery	1. Study of post-mortem changes; 2. Meat cutting and handling;	2.1 Factors affecting post-mortem changes, properties and shelf life of meat; 2.2 Mechanical deboning, grading and aging; Eating and cooking quality of meat; 2.3 Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives; 2.4 Meat tenderization; 2.5 Meat emulsions; 2.6 Meat cutting and handling;	Factors Affecting Post-mort em Changes: Eating and Cooking Quality

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT522.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO1:Preparation, Preservation, and Equipment for Smoked Meat: S02. Preparation, Packaging, and Equipment forDehydrated Meat Products: SO3: Preparation, Preservation, and Equipment for Meat Sausages: SO4: Abattoir Design and Layout: SO5: Sensory Evaluation Techniques:	1. Preservation of meat by freezing; 2. Preservation of meat by curing and pickling;	3.1 Preparation, preservation and equipment for manufacture of smoked meat. 3.2 Quality evaluation of smoked meet; 3.3 Preparation, packaging and equipment for manufacture of dehydrated meat products. 3.4 Quality evaluation of packaged meat products; 3.5 Preparation, preservation and equipment for manufacture of meat sausages and their quality evaluation; 3.6 Abattoir design and layout;	Study of Industry Practices: Hands-On Sausage Making:

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT522.4

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-4**	**Self Learning (SL)**
SO1: Structural Understanding: SO2. processing and Preservation Strategies: SO3: Poultry Meat Processing Skills: SO4: Sanitation Protocols Implementation: SO5:Quality Assurance System	1. Preservation of meat by dehydration 2. Evaluation of quality and grading of eggs;	4.1 Structure and composition of eggs. 4.2 Quality characteristics of eggs. 4.3 Processing and preservation of eggs; 4.4 Processing and preservation of poultry meat. 4.5 Processing and preservation of chicken patties; 4.6 Meat plant sanitation and safety;	1. Development of Safety Protocols:

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT522.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO1: To gain knowledge about the various by-products of poultry processing, including feathers, organs, and giblets. SO2: Discuss various methods for the effective utilization of by-products, such as rendering for fats and proteins, and applications in pet food, agriculture, pharmaceuticals, and cosmetics. SO3: Understanding the significance of ISO 22000 as an international standard for food safety management systems and its application in the meat industry. SO4: gain insights into the Meat Food Products Order (MFPO) and its role in regulating and maintaining standards in the Indian meat industry. SO5: Discuss the importance of complying with safety standards, conducting regular audits, and implementing best practices to ensure the overall safety and quality of meat products.	1. Preservation of shell eggs; 2. Preparation of value added poultry meat products;	5.1 By-products of meat, poultry and eggs. 5.2 Utilization of by-products 5.3 Safety standards in meat industry: 5.4 HACCP/ISO 5.5 MFPO/FS SAI 5.6 Kosher/Halal.	1. By-products Utilization:

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT522.1 Safety Assurance: Demonstrate a comprehensive understanding of safety protocols and regulatory compliance in the processing of meat and poultry, ensuring the production of products free from contaminants and pathogens.	6	4	1	1	12
54FT522.2 Quality Control Proficiency: Acquire the skills to implement effective quality control measures throughout the processing chain, ensuring consistent product quality, flavor, and texture.	6	4	1	1	12
54FT522.3 Technical Competence: Develop technical expertise in various processing methods, such as curing, smoking, cooking, and packaging, to meet industry standards and consumer expectations.	6	4	1	1	12
54FT522.4 HACCP Implementation: Apply Hazard Analysis and Critical Control Points (HACCP) principles to identify, assess, and control potential hazards, thereby enhancing the overall safety and integrity of processed meat and poultry products.	6	4	1	1	12
54FT522.5 Innovation and Product Development: Explore and implement innovative processing techniques to diversify product offerings, meeting market demands and consumer preferences while considering sustainability and efficiency in production.	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to meat source	3	5	2	10
CO-2	Post Mortem Operations	2	5	3	10
CO-3	Meat product developments	3	5	2	10
CO-4	Eggs:	2	5	3	10
CO-5	Certifications for meat and poultry products	3	5	2	10
Total		13	25	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing of Meat and Poultry Products will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Meat, Egg and Poultry Science & Technology	Vikas Nanda	I.K. International Publishing House Pvt. Ltd., New Delhi	2014
2	Outlines of Meat Science and Technology	B.D. Sharma and Kinshuki Sharma	Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi	2011
3	Meat Processing-Improving Quality	Joseph Kerry, John Kerry and David Ledward	Woodhead Publishing Ltd., Cambridge, England	2005
4	Preservation of Meat and Poultry	NIIR Board of Consultants & Engineers	Asia Pacific Business Press, Inc., Delhi	2005

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT522
Course Title: Processing of Meat and Poultry Products

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Safety Assurance: Demonstrate a comprehensive understanding of safety protocols and regulatory compliance in the processing of meat and poultry, ensuring the production of products free from	1	1	2	2	3	2	3	2	2	1	3	2	2	3	2	3

contaminants and pathogens.																
CO:2 Quality Control Proficiency: Acquire the skills to implement effective quality control measures throughout the processing chain, ensuring consistent product quality, flavor, and texture.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	2
CO:3 Technical Competence: Develop technical expertise in various processing methods, such as curing, smoking, cooking, and packaging, to meet industry standards and consumer expectations.	2	2	1	1	1	2	2	2	1	2	1	2	1	3	2	1
CO:4 HACCP Implementation : Apply Hazard Analysis and Critical Control Points (HACCP) principles to identify, assess, and control potential hazards, thereby enhancing the overall safety and integrity of processed meat and poultry	3	2	2	2	3	2	3	2	2	1	2	3	3	1	2	2

products.																
CO:5 Innovation and Product Development: Explore and implement innovative processing techniques to diversify product offerings, meeting market demands and consumer preferences while considering sustainability and efficiency in production.	1	1	1	1	1	3	3	3	1	1	2	2	3	2	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Introduction to meat source	**SOs 1-5**	4	Sources and importance of meat and poultry; Status of Meat and poultry industry in India; Pre-slaughter operations and slaughtering operations for animals and poultry; Evaluation of animal carcasses;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Post Mortem Operations	**SOs 1-5**	4	Factors affecting post-mortem changes, properties and shelf life of meat; Mechanical deboning, grading and aging; Eating and cooking quality of meat; Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives; Meat tenderization; Meat emulsions; Meat cutting and handling;	
PO 1 to 12 and PSO 1 to 4	CO3: Meat product developments	**SOs 1-5**	4	Preparation, preservation and equipment for manufacture of smoked meat and its quality evaluation; Preparation, packaging and equipment for manufacture of dehydrated meat products and their quality evaluation; Preparation, preservation and equipment for manufacture of meat sausages and their quality evaluation; Abattoir design and layout;	
PO 1 to 12 and PSO 1 to 4	CO4: Eggs:	**SOs 1-5**	4	Eggs: Structure, composition, quality characteristics, processing, preservation of eggs; Processing and preservation of poultry meat and chicken patties; Meat plant sanitation and safety;	
PO 1 to 12 and PSO 1 to 4	CO5: Certifications for meat and poultry products	**SOs 1-5**	4	By-products of meat, poultry and eggs and their utilization; Safety standards in meat industry: HACCP/ISO/MFPO/FSSAI/Kosher/Halal.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- V

Course Code:	54FT521
Course Title :	Processing Technology of Fruits and Vegetables
Pre- requisite:	Students should have basic knowledge of biology, chemistry, food science and engineering.
Rationale:	The students studying Processing Technology of Fruits and Vegetables is crucial for ensuring food security, reducing waste, improving economic prospects, maintaining health standards, fostering innovation and promoting sustainable practices. This subject also serves as a bridge between agricultural production and consumption, addressing critical aspects of food availability, safety, and market viability.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT521.1	Describe fruit and vegetable production in India and their various processing and preservation methods.
54FT521.2	Acquired the knowledge of supply chain, processing methods, and preservation techniques essential in the fresh fruit and vegetable industry.
54FT521.3	Understand the canning techniques, equipment, quality control measures, and the ability to produce safe and high-quality canned products.
54FT521.4	Knowledge, skills, and regulatory understanding needed to prepare and preserve a wide range of fruit-based products while ensuring compliance with FSSAI standards.
54FT521.5	Explain in brief about scientific knowledge of manufacturing of various values added products.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT521	Processing Technology of Fruits & Vegetables	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 521	Processing Technology of Fruits & Vegetables	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT521.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 Understand the present production scenario in India and World. SO1.2 Understand the present processing scenario in India and World. SO1.3 Understand the scope of processing industries in India. SO1.4 Understand the future prospects of processing industries in India. SO1.5 Overview of principles and processing methods.	Introduction to traditional methods of processing. Study on preserving action of sugar and salt.	1.1 Production and processing scenario of fruits and vegetables in India. 1.2 Production and processing scenario of fruits and vegetables in world. 1.3 Scope of fruit and vegetable processing industry in India. 1.4 Overview of principles of preservation methods of fruits and vegetables. 1.5 Traditional and modern methods.	Knowledge about state wise production scenario.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT521.2:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-2**	**Self Learning (SL)**
SO1.1 Understand supply chain management system. SO1.2 Understand primary processing and pack house handling. SO1.3 Understand size reduction operations. SO1.4 Understand minimal processing of fruits & vegetables. SO1.5 Understand methods and equipments of blanching.	Introduction to primary processing of selected fruit and vegetable. To study about blanching of selected vegetable.	2.1 Supply chain of fresh fruits and vegetables. 2.2 Primary processing 2.3 Pack house handling of fruits and vegetables. 2.4 Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables. 2.5 Minimal processing of fruits and vegetables. 2.6 Blanching operations and equipments. 2.7 Methods of blanching.	Knowledge about classification of various types of processing.

SW-2 Suggested Sessional Work (SW):
a. Assignments:
b. Mini Project:
c. Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT521.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO1.1 Understand history of canning. SO1.2 Understand need and importance of canning. SO1.3 Understand types of cans. SO1.4 Understand selection criteria for cans and container. SO1.5 Understand defects in canned products.	To study about canning of food. Introduction to types of packaging material used in canning.	3.1 Canning: Definition, processing steps, and equipment. 3.2 History of canning 3.3 Need and importance of canning. 3.4 Cans and containers. 3.5 Quality assurance of canned products. 3.6 Defects in canned products.	Knowledge about importance of time and temperature in heat treatment.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT521.4

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO1.1 Understand preparation and preservation of juice based beverages. SO1.2 Understand FSSAI specifications. SO1.3 Acquired the knowledge of crystallized fruit products. SO1.4 Understand various fruit preserves. SO1.5 Understand preparation and classification of candies.	To study about preparation of RTS. To study about preparation of squash.	4.1 FSSAI specifications and preparation and preservation of juices. 4.2 FSSAI specifications and preparation and preservation of squashes, syrups, nectars and cordials. 4.3 FSSAI specifications and preparation and preservation of sherbets 4.4 Processing and equipment for above products. 4.5 FSSAI specifications; Preparation, preservation and machines for manufacture of crystallized fruits. 4.6 Fruit preserves, jam, jelly and marmalades. 4.7 Candies.	Knowledge about specifications of equipment and machinery used in fruit processing industry.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT521.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO1.1 Understand preparation methods of selected value added products. SO1.2 Understand preservation methods of selected value added products. SO1.3 Understand dehydration of products. SO1.4 Understand production of pectin and vinegar. SO1.5 Understand commercial production for value added products.	To study about preparation of pectin. To study about preparation of vinegar.	5.1 Preparation, preservation and machines for manufacture of sauce, puree, paste, ketchup. 5.2 Chutney and pickles, toffee, cheese, lather. 5.3 Dehydrated, wafers, papads and Soup powders. 5.4 Production of pectin and vinegar; 5.5 Commercial processing technology of selected fruits and vegetables for production of various value added processed products.	Knowledge about challenges in fruits and vegetables processing industry.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT521.1: Describe fruit and vegetable production in India and their various processing and preservation methods.	5	4	1	1	11
54FT521.2: Acquired the knowledge of supply chain, processing methods, and preservation techniques essential in the fresh fruit and vegetable industry.	7	4	1	1	13
54FT521.3: Understand the canning techniques, equipment, quality control measures, and the ability to produce safe and high-quality canned products.	6	4	1	1	12
54FT521.4: Knowledge, skills, and regulatory understanding needed to prepare and preserve a wide range of fruit-based products while ensuring compliance with FSSAI standards.	7	4	1	1	13
54FT521.5: Explain in brief about scientific knowledge of manufacturing of various values added products.	5	4	1	1	11
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Production and processing scenario of fruits and vegetables in India and world.	03	02	01	06
CO-2	Supply chain and minimal processing of fresh fruits and vegetables.	03	05	03	11
CO-3	Canning techniques, equipment, quality control measures.	03	05	03	11
CO-4	Regulatory understanding needed to prepare and preserve a wide range of fruit-based products.	03	05	03	11
CO-5	Preparation and preservation of various value added products.	03	03	05	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing Technology of Fruits and Vegetables will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Preservation of Fruits and Vegetables	Girdhari Lal, G.S. Siddappa and G.L. Tandon	ICAR, New Delhi	1959
2	Post Harvest Technology of Fruits and Vegetables	P.H. Pandey	Saroj Prakashan, Allahabad	1997
3	Fruit & Vegetable Preservation: Principles and Practices	R.P. Srivastava and Sanjeev Kumar	International Book Distribution Co., Delhi	3rd Ed., 2002
4	Fruit and Vegetables: Harvest, Handling and Storage	A.K. Thompson	Blackwell Publishing Ltd., Oxford, UK	2nd Ed., 2003

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT521
Course Title: Processing Technology of Fruits & Vegetables

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Describe fruit and vegetable production in India and their various processing and preservation methods.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO:2 Acquired the knowledge of supply chain, processing methods, and	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3

preservation techniques essential in the fresh fruit and vegetable industry.																
CO:3 Understand the canning techniques, equipment, quality control measures, and the ability to produce safe and high-quality canned products.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO:4 Knowledge, skills, and regulatory understanding needed to prepare and preserve a wide range of fruit-based products while ensuring compliance with FSSAI standards.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO:5 Explain in brief about scientific knowledge of manufacturing of various values added products.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Production and processing scenario of fruits and vegetables in India and world.	**SOs 1-5**	4	Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India; Overview of principles and preservation methods of fruits and vegetables.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Supply chain and minimal processing of fresh fruits and vegetables.	**SOs 1-5**	4	Supply chain of fresh fruits and vegetables; Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables; Minimal processing of fruits and vegetables; Blanching operations and equipment.	
PO 1 to 12 and PSO 1 to 4	CO3: Canning techniques, equipment, quality control measures.	**SOs 1-5**	4	Canning: Definition, processing steps, and equipment, cans and containers, quality assurance and defects in canned products.	
PO 1 to 12 and PSO 1 to 4	CO4: Regulatory understanding needed to prepare and preserve a wide range of fruit-based products.	**SOs 1-5**	4	FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc.; Processing and equipment for above products; FSSAI specifications; Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and marmalades, candies.	
PO 1 to 12 and PSO 1 to 4	CO5: Preparation and preservation of various value added products.	**SOs 1-5**	4	Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, lather, dehydrated, wafers and papads, soup powders; Production of pectin and vinegar; Commercial processing technology of selected fruits and vegetables for production of various value added processed products.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT576
Course Title :	Skill Development (Confectionary)- Lab
Pre- requisite:	Students should have basic knowledge of confectionary including with different types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing of various confectionary products. They have to develop employability skills, intellectual skills, core of key skills and personal attributes with full responsibility and self-confidence.
Rationale:	The students studying Food Technology should possess foundational understanding about confectionary products including with their processing, packaging and storage conditions.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT576.1	Ability to develop employability skills in the field of confectionary.
54FT576.2	Ability to enhance technical knowledge and skills in the field of confectionary.
54FT576.3	Ability to assess the quality of confectionary products.
54FT576.4	Ability to recall the standards and regulations of confectionary industries.
54FT576.5	Ability to demonstrate skills in confectionary industries.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT576	Skill Development (Confectionary)-Lab	0	4	0	0	0	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		End Semester Practical Exam (ESPE) (Viva-Voce+Record)
			Viva Voce	Record	
PCFT	54FT576	Skill Development (Confectionary)-Lab	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment

The end of semester assessment, the student will be required to prepare a detailed project report on Skill Development (Confectionary) - Lab. The internal assessment will be carried out by the internal faculties.

Note:- Detailed assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Making project report and power point presentation.
2. Take guidance of concerned teacher.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT576
Course Title: Skill Development (Confectionary)-Lab

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology	Ability to use the research based innovative knowledge for SDGs
CO:1 Ability to develop employability skills in the field of confectionary.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:2 Ability to enhance technical	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3

knowledge and skills in the field of confectionary.																
CO:3 Ability to assess the quality of confectionary products.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:4 Ability to recall the standards and regulations of confectionary industries.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:5 Ability to demonstrate skills in confectionary industries.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Ability to develop employability skills in the field of confectionary.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO2: Ability to enhance technical knowledge and skills in the field of confectionary.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO3: Ability to assess the quality of confectionary products.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO4: Ability to recall the standards and regulations of confectionary industries.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO5: Ability to demonstrate skills in confectionary industries.	**SOs 1-5**			

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT523
Course Title :	Instrumental Techniques in Food Analysis
Pre- requisite:	Students should have basic knowledge of electrical and electronics engineering along with the food chemistry and physical properties of biomaterial along with the food quality parameter
Rationale:	The students studying B Tech (Food Technology) should possess basic understanding about the working principles and function of advance instruments used for the assessment of food quality. This course will improve their operational and analytical skill of laboratory equipments and apparatus for the assessment of food quality.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT523.1	Acquire the knowledge about Basic of Food quality analysis and quality parameter
54FT523.2	Understanding the various Principles of Chromatography and separation techniques used in food quality assesement along with the operational skill development of HPLC
54FT523.3	Understanding the various Principles of Immuno-assay techniques in food analysis and various advance techniques i.e. infra-red remote thermometry, radiation thermometers, FTIR measurements
54FT523.4	Acquire the knowledge about Rapid microbiological methods and Electronic noses and tongues
54FT523.5	Understanding the application and working principle of chemically sensitive semiconductor devices along with the biosensor used in food industry

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT523	Instrumental Techniques in Food Analysis	2	1	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 523	Instrumental Techniques in Food Analysis	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT523.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	06	04	01	01	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understanding the basic knowledge about food quality parameter and different analytical techniques SO1.2 Acquire the knowledge about Principles and methodology involved in analysis of foods: Rheological analysis, textural profile analysis of foods SO1.3 Knowledge about Methods of analysis: Proximate constituents, moisture, adulterations, minerals analysis SO1.4 Learning about Principles and methodology involved in analytical techniques: ion selective electrodes, spectroscopy, ultraviolet visible, florescence, SO1.5 Knowledge about infrared spectro-, atomic absorption and emission, mass spectroscopy, nuclear magnetic resonance and electron spin resonance;	1.1 Study on Sampling plan; 1.2 Study on Proximate analysis of Food	1.1 Concepts of food analysis; 1.2 Rules and regulations of food analysis; 1.3. Principles and methodology involved in analysis of foods: Rheological analysis, textural profile analysis of foods 1.4. Methods of analysis: Proximate constituents, moisture, adulterations, minerals analysis; 1.5. Principles and methodology involved in analytical techniques: ion selective electrodes, spectroscopy, ultraviolet visible, florescence, 1.6. infrared spectro-atomic absorption and emission, mass spectroscopy, nuclear magnetic resonance and electron spin resonance;	Detail description about atomic absorption and emission, mass spectroscopy

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT523.2:

Items	CL	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understanding about the HPLC and other advanced analytical techniques used in food industry SO2.2 Knowledge about the ion-exchange and size-exclusion method SO2.3 Understanding the working principle of high performance liquid chromatography SO2.4 Understanding about Separation techniques applied in food quality analysis SO2.5 Understanding ultracentrifugation, iso-electric focusing, isotopic techniques, manometric techniques	Study on working of HPLC Study on Separation techniques used in food quality analysis	2.1 Chromatography: Adsorption, column, partition, gel-filtration, affinity, 2.2 ion-exchange, size-exclusion method, gas-liquid 2.3 High performance liquid chromatography 2.4 Separation techniques: Dialysis, electrophoresis 2.5 sedimentation, ultra-filtration, 2.6 ultracentrifugation, iso-electric focusing, isotopic techniques, manometric techniques;	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT523.3:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-3**	**Self Learning (SL)**
SO3.1 Understanding about the Immuno assay techniques in food analysis and near infra-red absorption technology applied in food analysis SO3.2 Improvement in analytical skill and result interpretation of food quality analysis SO3.3 Understanding the working of infra-red absorption technology in food quality analysis SO3.4 Acquire the knowledge about infra-red remote thermometry and radiation thermometers SO3.5 Understanding the In-line and off-line FTIR measurements in food quality analysis	Study on Immuno assay techniques in food analysis Study on near infra-red absorption technology	3.1 Immuno assay techniques in food analysis; Evaluation of analytical data: 3.2 Accuracy and precision, statistical significance, co-relations regression, result interpretation; Instrumentation and sensors for the food industry; 3.3 Food compositional analysis using near infra-red absorption technology: Principles of measurement, instrumentation, applications in the food industry, power of process monitoring and trending, practical considerations for implementing on-line measurement, 3.4 practical aspects of infra-red remote thermometry, 3.5 radiation thermometers, measurement principles, practical situations, miscellaneous techniques; 3.6 In-line and off-line FTIR measurements, food applications, calibration and general aspects of routine use;	Study on Food compositional analysis using near infra-red absorption technology:

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT523.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding about Rapid microbiological method applied in food analysis and application of electronic nose and electronic tongue SO4.2 Learning about Conductance/impedance techniques for microbial assay; SO4.3 Understanding the working principle of electronic nose and electronic tounge SO4.4 Learning about application of Electronic noses, tongues and testers in food quality analysis SO4.5 Knowledge about Modelling the human nose	1-Study on Electronic noses 2- Study on electronic tongues	4.1 Rapid microbiological methods: Overview, Conductance/impedance techniques for microbial assay; 4.2 Chemosensors, biosensors, immunosensors; 4.3 Electronic noses and tongues: Sensors for food flavour and freshness, 4.4 Electronic noses, tongues and testers; 4.5 Introduction to flavour assessment, 4.6 Modelling the human nose, electronic nose, electronic tongue, marker chemical approach,	Detail notes on Biosensors used in food industry

SW-4 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT523.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Understanding the basics of chemically sensitive semiconductor devices SO5.2 Working principle of analytical instruments based on Solid-state sensor SO5.3 Acquire the knowledge about basic principles of amperometric, potentiometric and thermometric biosensors SO5.4 Acquire the knowledge about Acoustic sensors, optical immunosensors; Fluorescence sensor systems SO5.5 Learning about Novel sensing receptors	Study on various classification on biosensor used in food industry Write the detail notes on Chemically sensitive semiconductor devices	5.1 Chemically sensitive semiconductor devices: 5.2 Solid-state sensors for pH, acidity, ions, gases and volatiles, 5.3 Amperometric, potentiometric and thermometric biosensors; 5.4 Acoustic sensors, optical immunosensors; Fluorescence sensor systems; 5.5 Novel sensing receptors, sensor arrays. 5.6 Commercial biosensors.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT523.1 Acquire the knowledge about Basic of Food quality analysis and quality parameter	6	4	1	1	12
54FT523.2 Understanding the various Principles of Chromatography and separation techniques used in food quality assesement along with the operational skill development of HPLC	6	4	1	1	12
54FT523.3 Understanding the various Principles of Immuno-assay techniques in food analysis and various advance techniques i.e. infra-red remote thermometry, radiation thermometers, FTIR measurements	6	4	1	1	12
54FT523.4 Acquire the knowledge about Rapid microbiological methods and Electronic noses and tongues	6	4	1	1	12
54FT523.5 Understanding the application and working principle of chemically sensitive semiconductor devices along with the biosensor used in food industry	6	4	1	1	12
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Concepts of food analysis	5	5	2	12
CO-2	Chromatography	2	5	2	9
CO-3	Immuno assay techniques in food analysis	2	5	2	9
CO-4	Rapid microbiological methods	3	5	2	10
CO-5	Chemically sensitive semiconductor devices	3	5	2	10
Total		15	25	10	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Instrumental Techniques in Food Analysis will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Analysis Laboratory	S. Suzanne Nieisen.	Manual,. Springer, NY, USA.	2010, 2nd Ed
2	Handbook of Food Analysis Instruments.	Semih Ötles.	CRC Press, Boca Raton, FL, USA.	2009.
3	Modern Techniques for Food Authentication. S.	Da-Wen Sun.	Elsevier Inc., Burlington, MA, USA.	2008
4	Food Analysis,	Suzanne Nieisen	Kluwer Academic, New York, USA.	. 2003, 3rd Ed.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT523
Course Title: Instrumental Techniques in Food Analysis

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Acquire the knowledge about Basic of Food quality analysis and quality parameter	2	3	2	3	3	1	1	1	1	1	1	3	3	3	3	3
CO:2 Understanding the various Principles of Chromatography and separation techniques used in food quality assesement along with the operational skill development of HPLC	3	3	2	3	3	1	1	1	1	1	1	2	3	3	3	3

CO:3 Understanding the various Principles of Immuno-assay techniques in food analysis and various advance techniques i.e. infra-red remote thermometry, radiation thermometers, FTIR measurements	2	3	2	3	3	1	1	1	1	1	1	3	3	3	3	3
CO:4 Acquire the knowledge about Rapid microbiological methods and Electronic noses and tongues	3	2	3	3	3	1	1	1	1	1	1	3	3	3	3	3
CO:5 Understanding the application and working principle of chemically sensitive semiconductor devices along with the biosensor used in food industry	3	2	2	3	3	1	1	1	1	1	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Concepts of food analysis	**SOs 1-5**	4	Rules and regulations of food analysis; Principles and methodology involved in analysis of foods: Rheological analysis, textural profile analysis of foods; Methods of analysis: Proximate constituents, moisture, adulterations, minerals analysis; Principles and methodology involved in analytical techniques: ion selective electrodes, spectroscopy, ultraviolet visible, florescence, infrared spectro-, atomic absorption and emission, mass spectroscopy, nuclear magnetic resonance and electron spin resonance;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Chromatography	**SOs 1-5**	4	Adsorption, column, partition, gel-filtration, affinity, ion-exchange, size-exclusion method, gas-liquid, high performance liquid chromatography; Separation techniques: Dialysis, electrophoresis, sedimentation, ultra-filtration, ultracentrifugation, iso-electric focusing, isotopic techniques, manometric techniques;	
PO 1 to 12 and PSO 1 to 4	CO3: Immuno assay techniques in food analysis	**SOs 1-5**	4	Evaluation of analytical data: Accuracy and precision, statistical significance, co-relations regression, result interpretation; Instrumentation and sensors for the food industry; Food compositional analysis using near infra-red absorption technology: Principles of measurement, instrumentation, applications in the food industry, power of process monitoring and trending, practical considerations for implementing on-line measurement, practical aspects of infra-red remote thermometry, radiation thermometers, measurement principles, practical situations, miscellaneous techniques; In-line and off-line FTIR measurements, food applications, calibration and general aspects of routine use;	
PO 1 to 12 and PSO 1 to 4	CO4: Rapid microbiological methods	**SOs 1-5**	4	Overview, Conductance/impedance techniques for microbial assay; chemosensors, biosensors, immunosensors; Electronic noses and tongues: Sensors for food flavour and freshness, electronic noses, tongues and testers; Introduction to flavour assessment, modelling the human nose, electronic nose, electronic tongue, marker chemical approach,	
PO 1 to 12 and PSO 1 to 4	CO5: Chemically sensitive semiconductor devices	**SOs 1-5**	4	Solid-state sensors for pH, acidity, ions, gases and volatiles, amperometric, potentiometric and thermometric biosensors; Acoustic sensors, optical immunosensors; Fluorescence sensor systems; Novel sensing receptors, sensor arrays, commercial biosensors.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-V

Course Code:	54FT527
Course Title :	Marketing Management and International Trade
Pre- requisite:	Students should have basic knowledge of Principles of management and food business management
Rationale:	The students studying Food Technology should have managerial skill and import, export documentation of food business, this course will provide them the deep knowledge of domestic and international trade documentation and procedure so that they will be capable to handle and execute the domestic and international purchase orders very efficiently.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT527.1	Understanding about various concept and function of marketing management along with Concepts of marketing-mix, elements of marketing-mix; Market structure and consumer buying behaviour: micro- and macro-environments; Marketing research and marketing information systems; Market measurement, market forecasting, market segmentation, targeting and positioning; Allocation and marketing resources; Marketing planning process;
54FT527.2	Learning about Product policy and planning: Product-mix, product line, product life cycle; New product development process; Product brand, packaging, services decisions; Marketing channel decisions; Retailing, wholesaling and distribution; Pricing decisions; Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry; Promotion-mix decisions;
54FT527.3	Understanding about Advertising its Objectives, budget and advertising message, media planning, personal selling, publicity, sales promotion; World consumption of food: Patterns and types of food consumption across the globe;
54FT527.4	Knowledge about various concept of international marketing and world food trade practices along with consumption pattern of food in entire world
54FT527.5	Knowledge of working ,function and objectives of various national and international organization related with international trade

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT527	Marketing Management and International Trade	2	0	1	1	4	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Schement of Assessement (Marks)				
			Progressive Assesement		Internal Assessment (IA)	End Semester Examination (ESE)	Total Marks (SA1+SA2+IA+ ESE)
			SA1	SA2			
PCFT	54FT527	Marketing Management and International Trade	20	20	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT527.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understanding of various concept and process of marketing management SO1.2 Knoledge about element of marketing mix and Market structure and consumer buying behaviour SO1.3 To improve the analytical skill for market research along with the knowledge of micro- and macro-environments Marketing research and marketing information systems SO1.4 Analytical skill improvement for conducting the market survey for food industry SO1.5 Development of managerial skill for the marketing resources and marketing planning process		1.1 Marketing: Concept, functions, scope and marketing management; Process 1.2 Concepts of marketing-mix, elements of marketing-mix 1.3 Market structure and consumer buying behavior 1.4 Micro- and macro-environments Marketing research and marketing information systems 1.5 Market measurement, market forecasting, market segmentation, targeting and positioning Allocation marketing resources; 1.6 Marketing planning process	Case study about food product market potential in India

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT527.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Learning about product policy and planning for food industry SO2.2 Knowledge about new product development and packaging process for food industry SO2.3 Understanding about marketing channel decision SO2.4 Understanding about Pricing decisions; Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry SO2.5 Understanding about Promotion-mix decisions		2.1 Product policy and planning: Product-mix, product line, product life cycle; 2.2 New product development process; Product brand, packaging, services 2.3 Decisions; Marketing channel decisions; Retailing, wholesaling and distribution; 2.4 Pricing decisions; Price determination and pricing policy of milk 2.5 Products in organized and unorganized sectors of dairy industry; 2.6 Promotion-mix decisions;	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT527.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Knowledge of different tool of advertising and their application in food product marketing SO3.2 Understanding about media planning and personal selling SO3.3 Acquire the about sales promotion activities SO3.4 Knowledge about world consumption pattern of food SO3.5 Understanding about Patterns and types of food consumption across the globe		3.1 Advertising: Objectives, budget and advertising message, 3.2 media planning, personal selling 3.3 publicity, sales promotion 3.4 World consumption of food-an overview 3.5 Patterns and types of food consumption in India. 3.6 Patterns and types of food consumption across the world.	Study about various tool of advertisement

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT527.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Knowledge about distinguish features and introduction of international marketing for food industry SO4.2 Understanding of composition and direction of Indian exports, international marketing environment, SO4.3 Improvement in decision making for international trade and buying lead for food products SO4.4 Knowledge about licensing, joint ventures, direct investment and internationalization process, SO4.5 Understanding about various distribution channels;		4.1 Salient features of international marketing, 4.2 composition and direction of Indian exports. 4.3 International marketing environment, 4.4 deciding which and how to enter international market; Direct exports, indirect exports, 4.5 licensing, joint ventures, direct investment and internationalization process, 4.6 distribution channels;	Study on current status of international trade of food products in India

SW-4 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT527.5:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1 Knowledge about function and role of WTO in International Trade SO5.2 Knowledge about world trade agreement and their impact on food trade SO5.3 Understanding the export trend of food products in India SO5.4 Understanding the role and function of APEDA and Tea Board SO5.5 Understanding the role and function of Spice Board, MOFPI, etc.		5.1 World Trade Organization 5.2 world trade agreements related to food business, 5.3 export trends and prospects of food products in India; 5.4 Government institutions related to international food trade: APEDA, Tea Board, 5.5 Spice Board 5.6 MOFPI, etc.	

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT527.1Understanding about various concept and function of marketing management along with Concepts of marketing-mix, elements of marketing-mix; Market structure and consumer buying behaviour: micro- and macro-environments; Marketing research and marketing information systems; Market measurement, market forecasting, market segmentation, targeting and positioning; Allocation and marketing resources; Marketing planning process;	6	0	1	1	8
54FT527.2 Learning about Product policy and planning: Product-mix, product line, product life cycle; New product development process; Product brand, packaging, services decisions; Marketing channel decisions; Retailing, wholesaling and distribution; Pricing decisions; Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry; Promotion-mix decisions;	6	0	1	1	8
54FT527.3 Understanding about Advertising its Objectives, budget and advertising message, media planning, personal selling, publicity, sales promotion; World consumption of food: Patterns and types of food consumption across the globe;	6	0	1	1	8
54FT527.4 Knowledge about	6	0	1	1	8

various concept of international marketing and world food trade practices along with consumption pattern of food in entire world					
54FT527.5 Knowledge of working ,function and objectives of various national and international organization related with international trade	6	0	1	1	8
Total	30	00	5	5	40

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Marketing	5	3	2	10
CO-2	Product policy and planning	3	3	4	10
CO-3	Advertising	3	2	5	10
CO-4	Salient features of international marketing	2	4	4	10
CO-5	WTO and world trade agreements related to food business	3	5	2	10
Total		16	17	17	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Marketing Management and International Trade will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Marketing Management: A South Asian Perspective,	Philip Kotler, Kevin Lane Keller, Abraham Koshy, Mithileshwar Jha.	Pearson Education.	2013. 14th Ed.
2	Fundamentals of Marketing.	Willium J. Stanton.	Tata McGraw-Hill Publication, New Delhi.	1984.
3	International Business,	John Daniels, Lee Radebaugh, Brigham, Daniel Sullivan.	Pearson Education.	15th Ed.,
4	Marketing Management: A South Asian Perspective,	Philip Kotler, Kevin Lane Keller, Abraham Koshy, Mithileshwar Jha.	Pearson Education.	2013. 14th Ed.

Curriculum Development Team

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT527
Course Title: Marketing Management & International Trade

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Understanding about various concept and function of marketing management along with Concepts of marketing-mix, elements of marketing-mix; Market structure and consumer buying behaviour: micro- and macro-environments; Marketing research and marketing information systems; Market measurement, market forecasting, market segmentation, targeting and positioning; Allocation and marketing resources; Marketing planning process;	1	3	1	3	1	2	1	2	2	3	2	3	1	1	1	3

CO:2 Learning about Product policy and planning: Product-mix, product line, product life cycle; New product development process; Product brand, packaging, services decisions; Marketing channel decisions; Retailing, wholesaling and distribution; Pricing decisions; Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry; Promotion-mix decisions;	1	3	1	3	1	2	1	3	3	3	2	3	1	1	1	3
CO:3 Understanding about Advertising its Objectives, budget and advertising message, media planning, personal selling, publicity, sales promotion; World consumption of food: Patterns and types of food consumption across the globe;	1	2	1	3	3	2	1	2	2	3	3	3	1	1	1	3
CO:4 Knowledge about various concept of international marketing and world food trade practices along with consumption pattern of food in entire world	1	2	1	3	3	2	1	3	2	3	2	3	1	3	1	2
CO:5 Knowledge of working ,function and objectives of various national and international organization related with international trade	1	3	1	3	1	2	1	2	3	3	2	3	1	3	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Marketing	**SOs 1-5**	4	Concept, functions, scope and marketing management; Process: Concepts of marketing-mix, elements of marketing-mix; Market structure and consumer buying behaviour: micro- and macro-environments; Marketing research and marketing information systems; Market measurement, market forecasting, market segmentation, targeting and positioning; Allocation and marketing resources; Marketing planning process;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Product policy and planning	**SOs 1-5**	4	Product-mix, product line, product life cycle; New product development process; Product brand, packaging, services decisions; Marketing channel decisions; Retailing, wholesaling and distribution; Pricing decisions; Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry; Promotion-mix decisions;	
PO 1 to 12 and PSO 1 to 4	CO3: Advertising	**SOs 1-5**	4	Objectives, budget and advertising message, media planning, personal selling, publicity, sales promotion; World consumption of food: Patterns and types of food consumption across the globe;	
PO 1 to 12 and PSO 1 to 4	CO4: Salient features of international marketing	**SOs 1-5**	4	composition and direction of Indian exports, international marketing environment, deciding which and how to enter international market; Direct exports, indirect exports, licensing, joint ventures, direct investment and internationalization process, distribution channels;	
PO 1 to 12 and PSO 1 to 4	CO5: WTO and world trade agreements related to food business	**SOs 1-5**	4	export trends and prospects of food products in India; Government institutions related to international food trade: APEDA, Tea Board, Spice Board, MOFPI, etc.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- VI

Course Code:	**54FT626**
Course Title :	Food Additives and Preservatives
Pre- requisite:	Students should have basic knowledge of food chemistry and biological mechanism of chemicals along with the food quality parameter
Rationale:	The students studying B Tech (Food Technology) should possess basic understanding about the effect of different ambient condition and food additive chemicals on shelf life of food products. This course will improve their knowledge about the effect of different condition and chemicals on safety of the food products after and before packaging.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT626.1	Acquire the knowledge about Basic of food additives, their toxicology and safety evaluation
54FT626.2	Understanding about the function and role of different Food colors and dyes used in processed food
54FT626.3	Understanding the function of various natural and artificial food colorants and food preservatives used in processed food
54FT626.4	Acquire the knowledge about mechanism and function of various food additives in processed food
54FT626.5	Acquire the knowledge about, mechanism of enzymes in food processing and other additives (Acidity regulators and Emulsifiers) used as a flavor and taste enhancers in food products.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT626	Food Additives and Preservatives	1	2	1	1	5	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA1	SA2			
PCFT	**54FT626**	Food Additives and Preservatives	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT626.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1 Understanding about various food additives and their role in food products SO1.2 Acquire the knowledge about toxicological aspect of food additives SO1.3 Knowledge about naturally occurring food additives	Evaluation of GRAS aspect of food additive Estimation of chemical preservatives by TLC (organic and inorganic);	1.1 Intentional food additives and unintentional food additives. 1.2 Toxicological aspect of food additives and safety evaluation. 1.3 Naturally occurring food additives.	Detail notes on importance of food additives. Study about GRAS elements. .

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT626.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: Understanding about the introduction of different food colours used in processed food SO2.2: To Explore the manufacturing process of paper and its types in the context of packaging. SO2.3: Understanding about the introduction of pigments and their importance and utilization as food color.	Study on method of Identification of food colour by TLC (organic and inorganic) Study on method of Quantitative estimation of added dyes	2.1 Food colors and dyes: Regulatory aspects of dyes, 2.2 Food color (natural and artificial), . 2.3 pigments and their importance and utilization as food color.	Study on various artificial colours and their role in processed food quality Detail notes on pigments and their use in food products.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT626.3:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-3**	**Self Learning (SL)**
SO3.1: Acquire the knowledge about natural and artificial food colorants function and role in food products SO3.2: Understanding about the role and function of Food preservatives and their chemical action. SO3.3: Knowledge about Role and mode of action of salts, chelating agents, stabilizers and thickeners.	Study on Role and mode of action of chelating agent in fruit juice. Study on various food preservatives and their chemical action.	3.1 Processing of natural and artificial food colorants; 3.2 Food preservatives and their chemical action. 3.3 Role and mode of action of salts, chelating agents, stabilizers and thickeners.	Study on Class-I Preservatives Study on Class-II Preservatives

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT626.4

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1: Understanding the role and function of Humectants/polyhydric alcohol in food products SO4.2: Understanding the role and function of anti-caking agent, firming agent, flour bleaching in food products. SO4.3: Understanding the role and function of maturing agents, antioxidants, nutritional and non-nutritional sweeteners in food products..	Study on Role and mode of clarifying agent in fruit juices; Role and mode of antioxidant in frozen fish.	4.1 Humectants/polyhydric alcohol, 4.2 anti-caking agent, firming agent, flour bleaching 4.3 maturing agents, antioxidants, nutritional and non-nutritional sweeteners.	Role and function of Humectants in food products Study on , nutritional and non-nutritional sweeteners used in food products

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT626.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1: Knowledge about various classification of enzymes, their role and function in food products SO5.2: Understanding the role and function of fat substitutes, flavor and taste enhancers in food processing . SO5.3: Understanding the role and function of Acidity regulators and emulsifiers used in food products	Observation roll of leavening agents in baked products Observation on Preservation of coconut shreds using humectants	5.1 Production of enzymes, leavening agents. 5.2 fat substitutes, flavor and taste enhancers in food processing. 5.3 Acidity regulators; Emulsifiers. .	Study on various processed food products and role of enzymes in food quality. Study on role and function of emulsifiers in food products. .

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT626.1 Acquire the knowledge about Basic of food additives, their toxicology and safety evaluation	3	4	1	1	9
54FT626.2 Understanding about the function and role of different Food colors and dyes used in processed food	3	4	1	1	9
54FT626.3 Understanding the function of various natural and artificial food colorants and food preservatives used in processed food	3	4	1	1	9
54FT626.4 Acquire the knowledge about mechanism and function of various food additives in processed food	3	4	1	1	9
54FT626.5 Acquire the knowledge about, mechanism of enzymes in food processing and other additives (Acidity regulators and Emulsifiers) used as a flavor and taste enhancers in food products.	3	4	1	1	9
Total Hours	15	20	5	5	45

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Intentional and unintentional food additives, their toxicology and safety evaluation; Naturally occurring food additives.	5	3	2	10
CO-2	Food colors and dyes: Regulatory aspects of dyes, food color (natural and artificial), pigments and their importance and utilization as food color.	2	5	3	10
CO-3	Processing of natural and artificial food colorants; Food preservatives and their chemical action. Role and mode of action of salts, chelating agents, stabilizers and thickeners.	3	5	2	10
CO-4	Humectants/polyhydric alcohol, anti-caking agent, firming agent, flour bleaching and maturing agents, antioxidants, nutritional and non-nutritional sweeteners.	5	2	3	10
CO-5	Production of enzymes, leavening agents, fat substitutes, flavor and taste enhancers in food processing; Acidity regulators; Emulsifiers.	3	5	2	10
Total		18	20	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Additives and Preservatives will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Chemistry.	H.-D. Belitz, W. Grosch and P. Schieberle.	Springer-Verlag, Berlin,Heidelberg.	2009. 4th Edition.
2	Food Additives: Characteristics, Detection and Estimation.	S.N. Mahindru	Aph Publishing Corporation, New Delhi.	2008.
3	Handbook of Food Toxicology.	S.S. Deshpande.	Marcel and Dekker AG, Basel, Switzerland.	2002.
4	Food Chemistry.	H.-D. Belitz, W. Grosch and P. Schieberle.	Springer-Verlag, Berlin,Heidelberg.	2009. 4th Edition.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT626
Course Title: Food Additives and Preservatives

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Acquire the knowledge about Basic of food additives, their toxicology and safety evaluation	2	3	2	2	2	1	1	1	1	1	1	3	3	3	3	3
CO:2 Understanding about the function and role of different Food colors and dyes used in processed food.	2	2	2	2	2	1	1	1	1	1	1	2	3	3	3	3
CO:3 Understanding the function of various natural and artificial food colorants and food preservatives used in processed food.	2	2	2	2	2	1	1	1	1	1	1	3	3	3	3	3

CO:4 Acquire the knowledge about mechanism and function of various food additives in processed food.	3	2	3	3	3	1	1	1	1	1	1	3	3	3	3	3
CO:5 Acquire the knowledge about, mechanism of enzymes in food processing and other.	3	2	2	2	2	1	1	1	1	1	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Intentional and unintentional food additives, their toxicology and safety evaluation; Naturally occurring food additives.	**SOs 1-5**	4	Intentional and unintentional food additives, their toxicology and safety evaluation; Naturally occurring food additives	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Food colors and dyes: Regulatory aspects of dyes, food color (natural and artificial), pigments and their importance and utilization as food color.	**SOs 1-5**	4	Food colors and dyes: Regulatory aspects of dyes, food color (natural and artificial), pigments and their importance and utilization as food color	
PO 1 to 12 and PSO 1 to 4	CO 3: Humectants/polyhydric alcohol, anti-caking agent, firming agent, flour bleaching and maturing agents, antioxidants, nutritional and non-nutritional sweeteners.	**SOs 1-5**	4	Processing of natural and artificial food colorants; Food preservatives and their chemical action. Role and mode of action of salts, chelating agents, stabilizers and thickeners.	
PO 1 to 12 and PSO 1 to 4	CO4: Processing of natural and artificial food colorants; Food preservatives and their chemical action. Role and	**SOs 1-5**	4	Humectants/polyhydric alcohol, anti-caking agent, firming agent, flour bleaching and maturing agents, antioxidants, nutritional and non-nutritional sweeteners.	

	mode of action of salts, chelating agents, stabilizers and thickeners				
PO 1 to 12 and PSO 1 to 4	CO5: Production of enzymes, leavening agents, fat substitutes, flavor and taste enhancers in food processing; Acidity regulators; Emulsifiers.	**SOs 1-5**	4	Production of enzymes, leavening agents, fat substitutes, flavor and taste enhancers in food processing; Acidity regulators; Emulsifiers.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- VI

Course Code:	54FT623
Course Title :	Food Packaging Technology and Equipments
Pre- requisite:	Aspiring professionals in Food Packaging Technology and Equipment typically need a bachelor's degree in fields like food science or packaging engineering. Key prerequisites include knowledge of basic sciences, specialized packaging courses, and understanding materials properties. Practical experience through internships is valuable, along with strong communication skills. Familiarity with quality control, food safety regulations, and engineering processes is crucial. Continuous learning, computer proficiency, and awareness of regulatory compliance contribute to a well-rounded skill set for success in the field.
Rationale:	Food Packaging Technology and Equipment are essential for preserving food quality, ensuring safety, and reducing waste. They enable efficient production processes, enhance consumer convenience, and contribute to sustainability through innovative packaging solutions and eco-friendly practices.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT623.1	Develop a thorough understanding of the principles and concepts underlying food packaging, including material science, design considerations, and preservation techniques.
54FT623.2	Acquire hands-on experience with state-of-the-art packaging equipment, gaining technical proficiency in operating and maintaining machinery used in the food packaging industry.
54FT623.3	Learn the principles of quality control and assurance in food packaging, ensuring products meet industry standards, comply with regulations, and maintain high levels of safety and integrity.
54FT623.4	Explore and develop innovative packaging solutions that enhance shelf life, optimize storage conditions, and improve overall product quality, taking into consideration consumer preferences and sustainability.
54FT623.5	Gain knowledge of food safety regulations and industry standards, ensuring the ability to design packaging solutions that comply with local and international requirements.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT623	Food Packaging Technology & Equipments	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 623	Food Packaging Technology & Equipments	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT623.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1: To Explore industry-specific requirements for packaging in sectors such as food, pharmaceuticals, electronics, and textiles, identifying unique challenges and solutions. SO1.2: To Assess the environmental implications of packaging decisions, exploring sustainable practices and initiatives to address global concerns about packaging waste. SO1.3: To Understand the legal and regulatory requirements governing packaging practices in different countries, with a specific focus on India. SO1.4: To Discuss the societal and ethical dimensions of packaging, addressing issues such as product safety, labeling transparency, and social responsibility in the context of global and Indian markets. SO1.5: To stay informed about current market trends and emerging technologies in packaging, exploring how these developments influence global and Indian packaging landscapes.	Classification of various packages based on material and rigidity. Measurement of thickness of paper, paper boards.	1.1 History of packaging. 1.2 Current scenario of packaging industry 1.3 Packaging situations in World, India. 1.4 Need of packaging. 1.5 Package requirements, package functions.	Investigate the environmental aspects of packaging by exploring materials, life cycle assessments, and sustainable practices.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT623.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: Understand the broad classification of packaging materials, distinguishing between primary, secondary, and tertiary packaging. SO2.2: To Explore the manufacturing process of paper and its types in the context of packaging. SO2.3: Analyze the advantages of using corrugated and paperboard boxes, including their versatility, recyclability, and cost-effectiveness. SO2.4: Investigate the manufacturing processes of metal packaging materials, including aluminum, tinplate, and stainless steel. SO2.5: Classify different types of polymers used in packaging and understand their characteristics and Explore the properties of common plastics used in packaging, such as PET, HDPE, PVC, and PP.	Measurement of basic weight and grammage of paper and paperboards. Measurement of water absorption of paper, paper boards.	2.1 Package materials 2.2 Classification of packages. 2.3 Paper as package material, its manufacture, types, advantages of corrugated and paperboard boxes, etc.; 2.4 Glass as package material, manufacture, advantages, disadvantages 2.5 Metal (Aluminium/ tin/ SS) as package material-manufacture, advantages, Disadvantages 2.6 Plastic as package material, classification of polymers, properties of each plastics 2.7 Uses of each plastics;	Understand the classification of polymers, properties of plastics, and their uses.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT623.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1: to Understand the various lamination processes, including molding, injection, blow, and extrusion. SO3.2: Understand the need for aseptic packaging, its advantages, and the underlying processes. SO3.3: To Facilitate discussions on emerging trends and challenges in lamination and aseptic packaging. SO3.4: To Encourage self-directed learning on a specific aspect of lamination or aseptic packaging. SO3.5: Understand the importance of quality control in lamination and coating processes.	Measurement of bursting strength of paper, paper boards; Measurement of tear resistance of papers;	3.1 Lamination: Moulding-Injection, blow, extrusion; 3.2 Coating on paper and films; 3.3 Aseptic packaging: Need, Advantages and process. 3.4 Comparison of conventional and aseptic packaging. 3.5 System of aseptic packaging 3.6 Materials used in aseptic packaging;	Create a summary document outlining key concepts and differences between the lamination processes.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT623.4

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1: To Understand the fundamental theories and concepts related to permeability in packaging materials. SO4.2: Explore the specific permeability characteristics of gasses and vapors in packaging. SO4.3: Relate permeability characteristics to the specific packaging needs of different food products. SO4.4: Understand the transport properties of barrier materials and their role in controlling permeability. SO4.5: Understand the significance of aseptic packaging, its advantages, and the underlying sterilization processes.	Measurement of puncture resistance of paper and Paperboard. Measurement of tensile strength of paper, paper boards.	4.1 Permeability: Theoretical considerations, 4.2 permeability of gases and vapors; 4.3 Permeability of multilayer materials; 4.4 Permeability in relation to packaging requirement of foods; 4.5 Transport properties of barriers; 4.6 GTS 4.7 WVTS	Observe and identify permeability considerations in products around you.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT623.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1: To Understand how packages interact with the environment and its impact on the product. SO5.2: To Explore specialized packaging considerations for different types of foods. SO5.3: To explore functional tests to ensure the package meets performance requirements. SO5.4: To Engage in hands-on activities to simulate package-environment interactions and conduct tests. SO5.5: To Foster discussions on emerging trends and innovations in packaging simulations and testing.	Determination of lacquer integrity test; Drop test, Box compression test; Identification of plastic films;	5.1 Simulations of product 5.2 Package environment interaction; 5.3 Packaging of specific foods. 5.4 Mechanical tests of package. 5.5 Functional tests on package.	Summarize key concepts related to package-environment interaction.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT623.1: Develop a thorough understanding of the principles and concepts underlying food packaging, including material science, design considerations, and preservation techniques.	5	4	1	1	11
54FT623.2: Acquire hands-on experience with state-of-the-art packaging equipment, gaining technical proficiency in operating and maintaining machinery used in the food packaging industry.	7	4	1	1	13
54FT623.3: Learn the principles of quality control and assurance in food packaging, ensuring products meet industry standards, comply with regulations, and maintain high levels of safety and integrity.	6	4	1	1	12
54FT623.4: Explore and develop innovative packaging solutions that enhance shelf life, optimize storage conditions, and improve overall product quality, taking into consideration consumer preferences and sustainability.	7	4	1	1	13
54FT623.5: Gain knowledge of food safety regulations and industry standards, ensuring the ability to design packaging solutions that comply with local and international requirements.	5	4	1	1	11
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	History of packaging and Current scenario of packaging industry.	3	2	1	6
CO-2	Introduction to packaging materials.	3	5	3	11
CO-3	Understanding the lamination technology.	3	5	3	11
CO-4	Understanding permeability.	3	5	3	11
CO-5	Latest trends in packaging materials.	3	3	5	11
Total		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Packaging Technology and Equipments will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Packaging and Shelf Life – A Practical Guide	Gordon L. Robertson	CRC Press, Boca Raton,FL, USA	2010
2	Food Packaging: Principles and Practice	Gordon L. Robertson	CRC Press, Boca Raton,FL, USA	2014
3	Food Packaging Technology	Richard Coles, Berek McDowell and Mark J. Kirwan	Blackwell Publishing Ltd., Oxford, UK	2003
4	Innovations in Food Packaging	Jung H. Han	Elsevier Science & Technology Books, UK	2005

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT623
Course Title: Food Packaging Technology and Equipments

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Develop a thorough understanding of the principles and concepts underlying food packaging, including material science, design considerations, and preservation techniques.	3	2	2	2	2	2	1	3	1	3	1	1	3	3	3	3
CO:2 Acquire hands-on experience with state-of-the-art packaging equipment, gaining technical proficiency in operating and maintaining machinery used in the food packaging industry.	3	3	3	2	3	3	2	1	2	1	1	3	3	3	3	3
CO:3 Learn the principles of	3	3	3	2	3	3	1	1	2	2	1	3	3	3	3	3

quality control and assurance in food packaging, ensuring products meet industry standards, comply with regulations, and maintain high levels of safety and integrity.																
CO:4 Explore and develop innovative packaging solutions that enhance shelf life, optimize storage conditions, and improve overall product quality, taking into consideration consumer preferences and sustainability.	3	3	3	1	3	3	2	1	2	3	1	3	3	3	3	3
CO:5 Gain knowledge of food safety regulations and industry standards, ensuring the ability to design packaging solutions that comply with local and international requirements.	3	2	2	1	3	3	2	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: History of packaging and Current scenario of packaging industry.	**SOs 1-5**	4	Packaging situations in World, India; Need of packaging; Package requirements, package functions	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Introduction to packaging materials.	**SOs 1-5**	4	Package materials: Classification of packages, paper as package material, its manufacture, types, advantages of corrugated and paper board boxes, etc.; Glass as package material, manufacture, advantages, disadvantages; Metal(Aluminium/ tin/ SS) as package material-manufacture, advantages, disadvantages, plastic as package material, classification of polymers, properties of each plastics, uses of each plastics;	
PO 1 to 12 and PSO 1 to 4	CO3: Understanding the lamination technology.	**SOs 1-5**	4	Lamination: Moulding-Injection, blow, extrusion; Coating on paper and films; Aseptic packaging: Need, advantages, process, comparison of conventional and aseptic packaging, system of aseptic packaging and materials used in aseptic packaging;	
PO 1 to 12 and PSO 1 to 4	CO4: Understanding permeability.	**SOs 1-5**	4	Permeability: Theoretical considerations, permeability of gases and vapours; Permeability of multilayer materials; Permeability in relation to packaging requirement of foods; Transport properties of barriers;	
PO 1 to 12 and PSO 1 to 4	CO5: Latest trends in packaging materials.	**SOs 1-5**	4	Simulations of product: Package environment interaction; Packaging of specific foods, mechanical and functional tests on package.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- VI

Course Code:	54FT627
Course Title :	Food Quality, Safety, Standards and Certification
Pre- requisite:	Students should have basic knowledge of Physical, chemical and microbial quality of food products during processing and after processing including with application of Quality Management Systems, QSS; Quality circles, SQC, ISO system and HACCP certification procedures.
Rationale:	The students studying Food Technology should possess foundational understanding about quality system in various food industries including with Factors influencing the food qualities as harvesting practices, procedures, packaging, transportation, storage, processing, packaging and storage conditions of finished products and recording and reporting of quality control and its management.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT623.1	Understand the knowledge of quality attributes and measurement of defects in various foodsamples.
54FT623.2	Understand the knowledge of various factors influencing sensory measurements and analysisof flavor in various food samples.
54FT623.3	Analyze of different sensory tests in various food samples
54FT623.4	Evaluate the Physical, chemical and microbial quality in various food samples.
54FT623.5	Apply the knowledge of the QMS, QSS, Quality circles, SQC, ISO system and HACCP andtheir certification procedures.

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT627	Food Quality, Safety, Standards and Certification	3	2	1	1	7	4

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 627	Food Quality, Safety, Standards and Certification	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT627.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1: Knowledge about the different food quality attributes and its importance. SO1.2: Understand about the measurement and analysis of different parameters related to define the quality level of food. SO1.3: Knowledge about the different defects in food, isolation and standardization.	Identification of different defects and its effects on food acceptability. Measurement of defects, isolation and sorting of food products based on defects.	1.1 Food quality and its roll in food industry. 1.2 Measurement of color and its importance in consumer preference. 1.3 Define physico-chemical, biological and mechanical defects. 1.4 Separation of defected food and standardization of food.	Learn about the food quality and its roll in acceptability of different food. Importance of food quality in industry.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT627.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: Understand about flavor and taste its different aspects related to food quality. . SO2.2: Acquire the knowledge about odor and visual appeal of food products. SO2.3: Acquire knowledge about sensory tests, methods, difference in instrumental and organoleptic analysis and panel/judges instruction.	Study of taste, flavor, odor and visualization characters of food. Perform various sensory tests, judge the different products.	2.1 Human perception of taste, flavor, odor and other senses in response to food. 2.2 Define and classify the flavor & taste and effects on food quality. 2.3 Roll of odor and visual appeal of food products. Methods of calculate colors. 2.4 Sensory, instrumental and laboratory quality methods.	Understand the roll of human senses to assess food quality. Plan to judge and panel to analyse quality of food.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT627.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1: Understand the various techniques and methods to test the food sensorial properties. SO3.2: Acquire the knowledge of human tendency to accept and prefer the food products. SO3.3: Understand the need of sensory tests for analyze the consumer preferences study.	Perform the different tests for sensory tests based on different food products. Analyze the consumer survey of to know factors affecting acceptability and preference of food products.	3.1 Different tests for analyze the sensory score of food products. 3.2 Relevance of the sensory tests and suitability of tests for particular food. 3.3 human behavior towards food system and population study related to food acceptability. 3.4 Different factors affecting consumer preferences.	Importance of different senses related to food Psychological effect in preference to food. Variations and generalization of food products acceptability in large population.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT627.4

Items	CI	LI	SW	SL	Total
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1: Understand the different quality parameters related to food. SO4.2: Acquire the knowledge about processing and its effects on food quality. SO4.3: Learn about the different operation related to food quality before and after processing. SO4.4: Knowledge about different quality control, management and assurance practices related to food industry.	Analyze the different physico-chemical and microbial quality attributes of raw food material. Analysis of effect of different pre-processing and post-processing operations on food quality.	4.1 Different quality parameters of food and their roll in quality analysis. 4.2 Identification of changes in food during and after processing. 4.3 Effect of different processing methods on particular quality food quality. 4.4 Effect of different practices on food quality from harvesting to storage and transportation. 4.5 Different systems and procedure to assure and inspect to good quality food manufacturing.	Observe the effect of every operation related to food in food quality. Application of quality management practices to produce higher quality products. Functionality of quality management and assurance system

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT627.5:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1: Understand how quality monitoring system function. SO5.2: Procedure of different quality control and assurance system. SO5.3: Acquire knowledge about implementation of quality control and management system. SO5:4 Application of inspection, auditing and find loop holes to develop risk free operation and products.	Applicability of quality control system. Preparation of records and auditing procedure.	5.1 Difference between quality control, quality assurance and quality management system. 5.2 Different standards and practices for quality management and control system. 5.3 Implementation and auditing plan for quality control plan 5.4 Different organization and institutions to prepare standards and inspection for certification for quality assurance.	Roll of team work for food quality retention and enhancement. Importance of records and documentation in food industry.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT627.1: Understand the knowledge of quality attributes and measurement of defects in various foodsamples.	9	4	1	1	15
54FT627.2: Understand the knowledge of various factors influencing sensory measurements and analysisof flavor in various food samples.	9	4	1	1	15
54FT627.3: Learn the principles of quality control and assurance in food packaging, ensuring products meet industry standards, comply with regulations, and maintain high levels of safety and integrity.	9	4	1	1	15
54FT627.4: Analyze of different sensory tests in various food samples.	9	4	1	1	15
54FT627.5: Gain knowledge of food safety regulations and industry standards, ensuring the ability to design packaging solutions that comply with local and international requirements.	9	4	1	1	15
Total Hours	45	20	5	5	75

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Food quality: Definition and its role in food industry	3	2	1	6
CO-2	Roll of human senses to judge and judgment panel setup	3	5	3	11
CO-3	Different sensory tests and methods	3	5	3	11
CO-4	Food quality attributes and package of practices for quality control	3	5	3	11
CO-5	Food quality management system and principle tools	3	4	4	11
Total		15	21	14	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Quality, Safety, Standards and Certification will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Quality Assurance: Principles and Practices	Inteaz Alli	CRC Press, Boca Raton,FL, USA	2004
2	. Food Safety Handbook	Ronald H. Schmidt and Gary E. Rodrick	John Wiley & Sons, Inc., Hoboken. New Jersey, USA	2003
3	Food Safety and Food Quality	R.E. Hester and R.M. Harrison	Royal Society of Chemistry, Cambridge, UK.	2001

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT627
Course Title: Food Quality, Safety, Standards and Certification

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO: 1 Understand the knowledge of quality attributes and measurement of defects in various foodsamples.	1	2	2	2	2	2	1	3	1	3	1	1	3	3	3	3
CO: 2 Understand the knowledge of various factors influencing sensory measurements and analysis of flavor in various food samples.	1	3	3	2	3	3	2	1	2	1	1	3	3	3	3	3
CO: 3 Learn the principles of quality control and	1	3	3	2	3	3	1	3	2	2	1	3	3	3	3	2

assurance in food packaging, ensuring products meet industry standards, comply with regulations, and maintain high levels of safety and integrity.																
CO: 4 Analyze of different sensory tests in various food samples.	1	3	3	1	3	3	2	3	2	3	1	3	3	3	3	3
CO: 5 Gain knowledge of food safety regulations and industry standards, ensuring the ability to design packaging solutions that comply with local and international requirements.	1	2	2	1	3	3	2	3	2	2	1	3	3	3	3	1

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Food quality: Definition and its role in food industry	**SOs 1-5**	4	Food quality and its roll in food industry. Measurement of color and its importance in consumer preference. Define physico-chemical, biological and mechanical defects. Separation of defected food and standardization of food.	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Roll of human senses to judge and judgment panel setup	**SOs 1-5**	4	Human perception of taste, flavor, odor and other senses in response to food. Define and classify the flavor & taste and effects on food quality. Roll of odor and visual appeal of food products. Methods of calculate colors. Sensory, instrumental and laboratory quality methods.	
PO 1 to 12 and PSO 1 to 4	CO3: Different sensory tests and methods	**SOs 1-5**	4	Different tests for analyze the sensory score of food products. Relevance of the sensory tests and suitability of tests for particular food. Human behavior towards food system and population study related to food acceptability. Different factors affecting consumer preferences.	
PO 1 to 12 and PSO 1 to 4	CO4: Food quality attributes and package of practices for quality control.	**SOs 1-5**	4	Different quality parameters of food and their roll in quality analysis. Identification of changes in food during and after processing. Effect of different processing methods on particular quality food quality. Effect of different practices on food quality from harvesting to storage and transportation. Different systems and procedure to assure and inspect to good quality food manufacturing.	
PO 1 to 12 and PSO 1 to 4	CO5: Food quality management system and principle tools	**SOs 1-5**	4	Difference between quality control, quality assurance and quality management system. Different standards and practices for quality management and control system. Implementation and auditing plan for quality control plan. Different organization and institutions to prepare standards and inspection for certification for quality assurance.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-VI

Course Code:	54FT622
Course Title :	Food Plant Sanitation
Pre- requisite:	Students should have basic knowledge of current good manufacturing practices, standard operating procedures, good laboratory practices, sanitary design and construction for food processing.
Rationale:	The students studying Food Technology should possess foundational understanding about Sanitation laws and regulations and guidelines, establishment of sanitary, potential risks of food borne bioterrorism, bioterrorism protection measures, role of pest management in bio-security; Relationship of microorganisms to sanitation, allergens, allergen control, food contamination including with role of HACCP and Sanitary design and construction for food processing and role of sanitation in Meat and poultry, beverage and various food industries.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT622.1	Understand the knowledge of GMP, SOP, GLP, Sanitation Laws and Regulations and Guidelines.
54FT622.2	Acquired the knowledge of HACCP, QA, cleaning compounds, handling and storage precautions in sanitation.
54FT622.3	Acquired the knowledge of Sanitary Design and its Construction for Food Processing and Dairy Plants.
54FT622.4	Understand the knowledge of Sanitation in Meat and Poultry and Fruit and Vegetable Processing Plants.
54FT622.5	Understand the knowledge of Mycology of Beverage manufacture and sanitation in Alcoholic and Non-alcoholic Beverage Plants.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT622	Food Plant Sanitation	1	2	1	1	5	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 622	Food Plant Sanitation	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT622.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understand GMP, SOP, GLP and sanitation in food industry. SO1.2 Understand about sanitation laws and regulations and guidelines. SO1.3 Potential risks of food borne bioterrorism, bioterrorism protection measures. SO1.4 Relationship of microorganisms to sanitation and its control. SO1.5 Food contamination and its protection.	LI1.1 Estimation of BOD. LI2.2 Estimation of COD.	CI1.1 Basic knowledge of GMP, SOP and GLP in food industry. CI1.2 Current status of sanitary condition in dairy industry in India. CI1.3 Sanitation laws, regulations and guidelines. Prevention of contamination by using of various sanitizing methods.	SL1.1Knowledge about various sanitary condition in dairy industry in India.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT622.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 To Understand role of HACCP in food industry. SO2.2 To Understand about quality assurance for sanitation cleaning compounds. SO2.3 To understand handling and storage precautions during sanitation. SO2.4 To understand the knowledge about various sanitation equipments. SO2.5 To understand the knowledge about various sanitizing methods.	LI2.1 Determination of hardness of water. LI2.2 Good Manufacturing Practices (GMPs) and personal hygiene.	CI2.1 Role of HACCP in food industry. CI2.2 Quality assurance for sanitation cleaning compounds. Various handling practices used in sanitation. CI2.3 Discussion about various steps involved in sanitizing methods.	SL2.1 Knowing about various sanitizing methods used in food industry.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT622.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 To Understand Sanitary design and construction for food processing. SO3.2 To Understand about Low-moisture food manufacturing and storage sanitation. SO3.3 To understand Dairy processing plant sanitation. SO3.4 To understand the Role of pathogens in dairy plants. SO3.5 To learn about sanitation principles and cleaning equipments used in food industry.	LI3.1 Sewage treatment. LI3.2 Aerobic and anaerobic sludge treatment.	CI3.1 Different types of sanitary design in food industry. Storage condition of low moisture foods. CI3.2 Effect of pathogens in different food samples products. CI3.3 Cleaning agents used in food industry.	SL3.1 Knowing about various sanitary design and construction in food industry.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT622.4

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding the Role of sanitation and its principles in meat and poultry plant. SO4.2 Understanding about application of various sanitizers used for meat and poultry plants. SO4.3 Understanding the role of sanitation and its principles in Fruit and vegetable processing plant. SO4.4 Understanding the cleaners' sanitizers and cleaning procedures. SO4.5 Understanding the evaluation of sanitation effectiveness.	LI4.1 Lab demonstration on state of water. LI4.2 Study of CIP plant.	CI4.1 Application of sanitation in meat and poultry plant. CI4.2 Analysis of various steps of cleaning system in fruits and vegetables plants. CI4.3 Brief Calculate sanitation effectiveness of food plants especially of meat, poultry and FV plants. Various unit operations applied during sanitation in food plants.	SL4.1 Knowing about various applications of sanitation in food plants.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT622.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Knowledge about the application of sanitation in beverage plant. SO5.2 Knowledge about Mycology of beverage manufacture. SO5.3 Knowledge about principles of sanitation in food plants. SO5.4 Knowledge about non-alcoholic beverage plant sanitation. SO5.5 Knowledge about brewery, winery, distillery sanitation.	LI5.1 Bacteriological examination of water. LI5.2 Sampling of airborne microorganism.	CI5.1 Sanitation and its application in various beverage plants in India. CI5.2 Steps involved in sanitation in food plants. Mycology of beverage manufacture. CI5.3 Overview on various sanitation techniques used in food plants specially about Alcoholic and Non-alcoholic beverage plants.	SL5.1 Application of various sanitation techniques used in Alcoholic and Non-alcoholic beverage plants.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT622.1: Understand the knowledge of GMP, SOP, GLP, Sanitation Laws and Regulations and Guidelines.	3	4	1	1	9
54FT622.2: Acquired the knowledge of HACCP, QA, cleaning compounds, handling and storage precautions in sanitation.	3	4	1	1	9
54FT622.3: Acquired the knowledge of Sanitary Design and its Construction for Food Processing and Dairy Plants.	3	4	1	1	9
54FT622.4: Understand the knowledge of Sanitation in Meat and Poultry and Fruit and Vegetable Processing Plants.	3	4	1	1	9
54FT622.5: Understand the knowledge of Mycology of Beverage manufacture and sanitation in Alcoholic and Non-alcoholic Beverage Plants.	3	4	1	1	9
Total	15	20	5	5	45

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	GMP, SOP, GLP, Sanitation Laws and Regulations and Guidelines.	3	2	1	6
CO-2	HACCP, QA, cleaning compounds, handling and storage precautions in sanitation.	3	5	3	11
CO-3	Sanitary Design and its Construction for Food Processing and Dairy Plants.	3	5	3	11
CO-4	Sanitation in Meat and Poultry and Fruit and Vegetable Processing Plants.	3	5	3	11
CO-5	Mycology of Beverage manufacture and sanitation in Alcoholic and Non-alcoholic Beverage Plants	3	3	5	11
Total		12	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food Plant Sanitation will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices	Michael M. Cramer	CRC Press, Boca Raton, FL, USA	2013
2	Environmental Microbiology	Ralph Mitchell and Ji-Dong Gu	John Wiley & Sons, Inc., Hoboken, New Jersey, USA	2nd Edition, 2010
3	Principles of Food Sanitation	Norman G. Marriott and Robert B. Gravani	Springer Science+Business Media, Inc., NY, USA	5th Edition, 2006
4	Food Plant Sanitation	Y. H. Hui, Bernard L. Bruinsma, J. Richard Gorham, Wai-Kit Nip, Phillip S. Tong	Marcel Dekker, NY, USA	2003

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT622
Course Title: Food Plant Sanitation

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Understand the knowledge of GMP, SOP, GLP, Sanitation Laws and Regulations and Guidelines.	3	2	1	1	2	3	3	2	3	3	2	3	3	3	3	3
CO:2 Acquired the knowledge of HACCP, QA, cleaning compounds, handling and storage precautions in sanitation.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:3 Acquired the knowledge of Sanitary Design and its Construction for Food Processing and Dairy Plants.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3

CO:4 Understand the knowledge of Sanitation in Meat and Poultry and Fruit and Vegetable Processing Plants.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:5 Understand the knowledge of Mycology of Beverage manufacture and sanitation in Alcoholic and Non-alcoholic Beverage Plants.	3	2	1	2	3	3	3	2	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: GMP, SOP, GLP, Sanitation Laws and Regulations and Guidelines	**SOs 1-5**	4	Good manufacturing practices, current good manufacturing practices; Standard operating procedures, good laboratory practices, sanitation; Sanitation and the food industry: Sanitation, sanitation laws and regulations and guidelines, establishment of sanitary, potential risks of food borne bioterrorism, bioterrorism protection measures, role of pest management in bio-security; Relationship of microorganisms to sanitation, allergens, allergen control; Food contamination, protection against contamination; Personal hygiene and sanitary food handling:	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: HACCP, QA, cleaning compounds, handling and storage precautions in sanitation.	**SOs 1-5**	4	Role of HACCP in sanitation, quality assurance for sanitation cleaning compounds, handling and storage precautions; Sanitizers, sanitizing methods, sanitation equipment, waste product handling, solid waste disposal, liquid waste disposal; Pest control: Insect infestation, cockroaches, insect destruction, rodents, birds, use of pesticides, integrated pest management;	
PO 1 to 12 and PSO 1 to 4	CO3: Sanitary Design and its Construction for Food Processing and Dairy Plants.	**SOs 1-5**	4	Sanitary design and construction for food processing: Site selection, site preparation, building construction considerations, processing and design considerations, pest control design; Low-moisture food manufacturing and storage sanitation: Sanitary construction considerations, receipt and storage of raw materials, cleaning of low-moisture food manufacturing plants; Dairy processing plant sanitation: Role of pathogens, sanitary construction considerations, soil characteristics in dairy plants, sanitation principles, cleaning equipment;	
PO 1 to 12 and PSO 1 to 4	CO4: Sanitation in Meat and Poultry and Fruit and Vegetable Processing Plants.	**SOs 1-5**	4	Meat and poultry plant sanitation: Role of sanitation, sanitation principles, cleaning compounds for meat and poultry plants, sanitizers for meat and poultry plants, sanitation practices, sanitation procedures; Sea food plant sanitation: Sanitary construction considerations, contamination sources, sanitation principles, recovery of by-products; Fruit and vegetable processing plant sanitation: Contamination sources, sanitary construction considerations, cleaning considerations, cleaning of processing plants, cleaners and sanitizers, cleaning procedures, evaluation of sanitation effectiveness;	
PO 1 to 12 and PSO 1 to 4	CO5: Mycology of Beverage manufacture and sanitation in Alcoholic and Non-alcoholic Beverage Plants	**SOs 1-5**	4	Beverage plant sanitation: Mycology of beverage manufacture, sanitation principles, non-alcoholic beverage plant sanitation, brewery sanitation, winery sanitation, distillery sanitation;	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-VI

Course Code:	54FT624
Course Title :	Processing of Fish and Marine Products
Pre- requisite:	A foundational understanding of basic food safety principles, knowledge of seafood biology and quality attributes, and familiarity with relevant regulations. Additionally, proficiency in handling and processing equipment, awareness of sustainability practices, and a grasp of seafood processing techniques are essential.
Rationale:	The rationale for processing fish and marine products lies in enhancing their shelf life, ensuring food safety, and meeting consumer demands for convenience. Processing methods such as freezing, canning, and smoking not only preserve the nutritional value of seafood but also facilitate distribution to diverse markets. Moreover, processing helps reduce post-catch losses, minimizes waste, and supports economic viability within the seafood industry.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT422.1	Develop an understanding of the factors influencing the quality of fish and marine products, including freshness, texture, flavor, and nutritional content.
54FT422.2	Acquire proficiency in various seafood processing techniques such as freezing, canning, smoking, and drying, considering the specific requirements of different fish species.
54FT422.3	Implement effective quality control measures throughout the seafood processing chain, ensuring consistency and compliance with industry standards.
54FT422.4	Explore opportunities for value addition and product innovation in seafood processing, developing the ability to create marketable and unique marine products.
54FT422.5	Manage and navigate the regulatory landscape governing seafood processing, including international standards, certifications, and local health regulations.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT624	Processing of Fish and Marine Products	2	1	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 624	Processing of Fish and Marine Products	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT624.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1: To Understand Fisheries Resources and Knowledge of Fish and Marine Products: SO1.2: To Study Classification and Composition of Fish SO1.3: To Study Characteristics of Fresh Fish: SO1.4: To study Spoilage of Fish SO1.5. To study Characteristics of Fresh Fish	1. Study of anatomy and dressing of fish; 2. Study of anatomy and dressing of prawn and other marine products;	1.1 Types of fish and other marine products; 1.2 Classification of fish (freshwater and marine), 1.3 composition of fish, 1.4 characteristics of fresh fish, 1.5 spoilage of fish microbiological, 1.6 physiological, biochemical;	1. Explore Seafood Markets

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT624.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: To Examine the changes in quality parameters of fish during both chilled and frozen storage, considering microbiological, chemical, and physical alterations over time. SO2.2: To Comprehend the correlation between chilling processes and the extended storage life of fish, exploring the impact of temperature control on freshness and quality preservation SO2.3: To Gain insights into the general aspects of fish freezing, including techniques, equipment, and the impact of freezing methods on the texture, flavor, and nutritional content of fish. SO2.4: To Understand the principles of canning in fish processing and the effects of heat processing on fish quality. Explore the relationship between canning techniques and preservation. SO2.5: To Understand the principles of canning in fish processing and the effects of heat processing on fish quality. Explore the relationship between canning techniques and preservation.	Identification of different types of fish - Selection and grading; Identification of different types of prawn and other marine products - Selection and grading;	2.1 Relationship between chilling and storage life, 2.2 MAP, general aspects of fish freezing, changes in quality during chilled and frozen storage; 2.3 Principles of canning, effect of heat processing on fish, storage of canned fish, 2.4 pre-process operations, 2.5 post-process operations, 2.6 cannery operations for specific canned products;	Explore Industry Reports

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT624.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1: To study Preparation, Preservation, and Equipment for fish products SO3.2. To study Preparation, Packaging, and Equipment for fish proteins extract. SO3.3: To study Preparation, Preservation, and Equipment for surimi.	1. Quality evaluation of fish; 2. Preparation of sun dried and salt cured fish, fish sauce;	3.1 Fish products: Introduction, fish muscle proteins 3.2 surimi process, traditional and modern surimi production lines, 3.3 quality of surimi products, 3.4 comparison of surimi and fish mince products; 3.5 Fish protein concentrates (FPC), 3.6 fish protein extracts (FPE), fish protein hydrolysates (FPH)	1. Surimi Process Observations

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT624.4

Items	CI	LI	SW	SL	Total
Approx. Hours	2	4	1	1	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1. Understanding and comparing traditional preparation methods for fish sauce and paste with novel or innovative approaches. SO4.2. Identifying key quality parameters for fish sauce and paste, such as color, salt content, and pH. SO4.3. Assessing the nutritional content of fish sauce and paste from traditional and novel methods. SO4.4. Exploring technological innovations in the processing of fish sauce and paste. SO4.5. Understanding the cultural and historical context of fish sauce and paste preparation.	1. Chilling and freezing of fish; Preparations of fish 2. protein concentrate; Preparation of fish meal;	4.1 Preparation protocols of indigenous products: 4.2. Fish sauce and paste. Novel methods;	Explore recent research papers and journals that discuss advancements in the preparation of indigenous fish products.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT624.5:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	10	4	1	1	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-5**	**Self Learning (SL)**
SO5.1: To Comprehend the principles and applications of advanced seafood preservation methods, including low dose irradiation and high-pressure treatment. SO5.2. To understand the use of preservative agents like oxygen absorbents, CO2 generators, and ethanol vapor in seafood packaging. SO5.3: To Explore the concept of value-added fish products and innovative packaging strategies. SO5.4: Understand the principles of seafood quality assurance, including the implementation of Hazard Analysis and Critical Control Points (HACCP). SO5.5: Identify and analyze new quality and safety challenges emerging in seafood processing and preservation.	Preparation of marine fish oils and various fish products; Utilization of fish by-products;	5.1 Low dose irradiation; 5.2 High pressure treatment, 5.3 MAP, 5.4 vacuum packaging, 5.5 gas packaging; 5.6. Oxygen absorbents and CO 2 generators, ethanol vapour generation, hurdle barrier concept, 5.7 value added fish products, packaging; 5.8. Sea food quality assurance, 5.9 HACCP, EU hygienic regulations and ISO 9000 standards; 5.10 New kinds of quality and safety problems emerging in sea food processing and preservation.	Case Studies

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
Develop an understanding of the factors influencing the quality of fish and marine products, including freshness, texture, flavor, and nutritional content.	6	4	1	1	12
Acquire proficiency in various seafood processing techniques such as freezing, canning, smoking, and drying, considering the specific requirements of different fish species.	6	4	1	1	12
Implement effective quality control measures throughout the seafood processing chain, ensuring consistency and compliance with industry standards.	6	4	1	1	12
Explore opportunities for value addition and product innovation in seafood processing, developing the ability to create marketable and unique marine products.	2	4	1	1	8
Manage and navigate the regulatory landscape governing seafood processing, including international standards, certifications, and local health regulations.	10	4	1	1	16
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Fisheries resources, global and Indian scenario	3	5	2	10
CO-2	Processing and Preservation methods	2	5	3	10
CO-3	Fish products preparation methods	3	5	2	10
CO-4	Indigenous fish products production	2	5	3	10
CO-5	Novel technologies for fish and marine products	3	5	2	10
Total		13	25	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing of Fish and Marine Products will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Advances in Fish Processing Technology	D.P. Sen	Allied Publishers Pvt. Ltd., Delhi	2005
2	Code of Practices of Canned Fishery products	FAO	FAO, UN, Rome	2003
3	Textbook of Fish Processing Technology	K. Gopakumar	ICAR, New Delhi	
4	Processing and Preservation of Fish	Charles L. Cutting	Agro Bios, New Delhi	

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT624
Course Title: Processing of Fish and Marine Products

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Develop an understanding of the factors influencing the quality of fish and marine products, including freshness, texture, flavor, and nutritional content.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	2	3
CO:2 Acquire proficiency in various seafood processing techniques such as freezing, canning, smoking, and drying, considering the specific requirements of different fish species.	1	1	2	2	1	2	3	2	1	2	2	2	2	2	2	3
CO:3 Implement effective	2	2	1	1	1	2	2	2	1	1	2	1	3	3	2	1

quality control measures throughout the seafood processing chain, ensuring consistency and compliance with industry standards.																
CO:4 Explore opportunities for value addition and product innovation in seafood processing, developing the ability to create marketable and unique marine products.	3	2	2	2	3	2	3	2	2	1	2	3	3	1	2	2
CO:5 Manage and navigate the regulatory landscape governing seafood processing, including international standards, certifications, and local health regulations.	1	1	1	1	1	3	3	3	1	1	2	2	3	2	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Fisheries resources, global and Indian scenario	**SOs 1-5**	4	Fisheries resources, global and Indian scenario; Types of fish and other marine products; Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Processing and Preservation methods	**SOs 1-5**	4	Relationship between chilling and storage life, MAP, general aspects of fish freezing, changes in quality during chilled and frozen storage; Principles of canning, effect of heat processing on fish, storage of canned fish, pre-process operations, post-process operations, cannery operations for specific canned products;	
PO 1 to 12 and PSO 1 to 4	CO3: Fish products preparation methods	**SOs 1-5**	4	Fish products: Introduction, fish muscle proteins, surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products; Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysates (FPH);	
PO 1 to 12 and PSO 1 to 4	CO4: Indigenous fish products production	**SOs 1-5**	4	Preparation protocols of indigenous products: Fish sauce and paste. Novel methods;	
PO 1 to 12 and PSO 1 to 4	CO5: Novel technologies for fish and marine products	**SOs 1-5**	4	Low dose irradiation; High pressure treatment, MAP, vacuum packaging, gas packaging; Oxygen absorbents and CO_2 generators, ethanol vapour generation, hurdle barrier concept, value added fish products, packaging; Sea food quality assurance, HACCP, EU hygienic regulations and ISO 9000 standards; New kinds of quality and safety problems emerging in sea food processing and preservation.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- VI

Course Code:	54FT621
Course Title :	Processing Technology of Beverages
Pre- requisite:	Successful beverage processing demands high-quality raw materials, stringent hygiene practices, suitable processing equipment, and adherence to regulations. Quality control measures, energy efficiency, and staff training are crucial. Efficient supply chain management, waste reduction, and traceability systems complete the prerequisites for a successful beverage processing operation.
Rationale:	The adoption of advanced processing technology in beverages is driven by its capacity to ensure consistent quality, enhance efficiency, and meet stringent safety standards. Automation minimizes errors, supports regulatory compliance, and contributes to sustainability through energy-efficient features. Real-time monitoring enables quick adjustments, reducing waste and aligning with industry trends toward innovation and meeting consumer demands.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT621.1	Gain proficiency in the application of different processing techniques, including pasteurization, fermentation, carbonation, and blending, based on the type of beverage.
54FT621.2	Understand the selection and quality assessment of raw materials such as fruits, grains, and water, considering their impact on the final product.
54FT621.3	Develop an understanding of hygiene and sanitation practices critical to preventing contamination during beverage processing.
54FT621.4	Implement quality control measures at various stages of production, including sensory evaluations and laboratory testing, to ensure product consistency and compliance with standards.
54FT621.5	Acquire knowledge about production and processing of miscellaneous beverages.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT621	Processing Technology of Beverages	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 621	Processing Technology of Beverages	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT621.1:

Items	**CI**	**LI**	**SW**	**SL**	**Total**
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI) Unit-1**	**Self Learning (SL)**
SO1.1: To Gain insights into the historical development of beverages, tracing the origins and cultural significance of various types of drinks. SO1.2: Understand the cultural and social roles beverages have played throughout history, considering their influence on traditions, rituals, and societal interactions. SO1.3: Explore the nutritional aspects of different beverages, including their impact on health and well-being, and understand their role in diverse diets. SO1.4: Explore the rise of major players in the beverage industry, understanding the strategies and innovations that have contributed to their success. SO1.5: Understand how technological advancements and innovation have transformed the beverage industry, from production processes to marketing strategies.	Determination of density and viscosity of caramel. Determination of colors in soft drinks by wool technique.	1.1 History of beverages. 1.2 Health importance of beverages. 1.3 Status of beverage industry in India. 1.4 Status of beverage industry in world. 1.5 Classification of beverages.	Utilize online libraries and archives to access academic papers, historical documents, and scholarly articles on beverages.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT621.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: To Gain insights into the specific processing techniques and technologies employed in the production of each beverage category. SO2.2: Explore the packaging considerations unique to each beverage category. SO2.3: Gain awareness of the regulatory frameworks and compliance standards specific to each beverage category. SO2.4: Explore innovations and emerging trends in beverage processing. Understand how the industry responds to changing consumer preferences, technological advancements, and sustainability considerations. SO2.5: Explore sustainable practices and initiatives aimed at reducing the industry's ecological footprint, including packaging materials and waste management.	Quality analysis of raw water. Preparation of iced and flavored tea.	2.1 Packaged drinking water 2.2 Juice based and synthetic beverages 2.3 Carbonated beverages 2.4 Low-calorie and dry beverages 2.5 Isotonic and sports drinks, dairy based beverages 2.6 Alcoholic beverages, fruit beverages. 2.7 Speciality beverages, tea, coffee, cocoa, spices, plant extracts, etc.;	Access industry reports and whitepapers published by beverage associations, research institutions, or market research firms.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT621.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1: To Gain a thorough understanding of the Food Safety and Standards Authority of India (FSSAI) regulations applicable to the beverage industry. S03.2: To Acquire knowledge about the documentation and regulatory filings required by FSSAI for beverage products. SO3.3: Explore the FSSAI specifications for different beverage ingredients, including permissible additives, preservatives, colorants, and flavorings. SO3.4: Learn about the types of equipment used in beverage manufacturing and how they comply with FSSAI standards. SO3.5: Explore FSSAI specifications for beverage packaging materials and processes.	Preparation of carbonated and non-carbonated beverages. Determination of caffeine in beverages.	1.1 FSSAI specifications for juice based beverages. 1.2 FSSAI specifications for carbonated beverages. 1.3 Ingredients used in beverages. 1.4 Manufacturing process of beverages. 1.5 Equipments used for beverage processing. 1.6 Packaging materials used for beverages.	Explore industry reports and publications that discuss FSSAI regulations in the context of beverage manufacturing.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT621.4

Items	CI	LI	SW	SL	Total
Approx. Hours	7	4	1	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1: To gain an in-depth understanding of water treatment processes essential for beverage production. SO4.2: To become familiar with various additives used in beverage manufacturing. SO4.3: comprehend the science behind carbonation in beverages and the role of carbon dioxide SO4.4: To learn about the various quality tests employed in the beverage industry. SO4.5: To gain knowledge about instrumental techniques used for quality control in beverages.	Determination of brix value, gas content, pH and acidity of beverages. Quality analysis of tea and coffee.	4.1 Water treatment and quality of process water. 4.2 Sweeteners 4.3 Colorants 4.4 Acidulants 4.5 Clouding, clarifying and flavoring agents for beverages. 4.6 Carbon dioxide and carbonation. 4.7 Quality tests and control in beverages.	Explore scientific journals that publish research papers on beverage technology and food science.

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT621.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1: To gain insights into the production of coconut water, covering harvesting, extraction, and processing methods. SO5.2: Learn about various techniques for extracting sugar cane juice. SO5.3: Understand the processing steps involved in producing coconut milk, including extraction and filtration. SO5.4: To gain knowledge about the formulation of flavored syrups. SO5.5: Explore current market trends and consumer preferences related to miscellaneous beverages.	Preparation of miscellaneous beverages; Visit to carbonation unit;	5.1 Manufacturing of coconut water 5.2 Sweet toddy 5.3 Sugar cane juice 5.4 Coconut milk 5.5 Flavored syrups.	Explore research papers and journals that focus on the nutritional aspects, processing methods, and cultural significance of miscellaneous beverages.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT621.1: Gain proficiency in the application of different processing techniques, including pasteurization, fermentation, carbonation, and blending, based on the type of beverage.	5	4	1	1	11
54FT621.2: Understand the selection and quality assessment of raw materials such as fruits, grains, and water, considering their impact on the final product.	7	4	1	1	13
54FT621.3: Develop an understanding of hygiene and sanitation practices critical to preventing contamination during beverage processing.	6	4	1	1	12
54FT621.4: Implement quality control measures at various stages of production, including sensory evaluations and laboratory testing, to ensure product consistency and compliance with standards.	7	4	1	1	13
54FT621.5: Acquire knowledge about production and processing of miscellaneous beverages.	5	4	1	1	11
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to beverage	03	02	01	06
CO-2	Beverage Processing	03	05	03	11
CO-3	Comprehensive Insights into FSSAI Specifications.	03	05	03	11
CO-4	Key Elements of Beverage Production.	03	05	03	11
CO-5	Exploring the World of Miscellaneous Beverages.	03	03	05	11
Total		15	15	20	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Processing Technology of Beverages will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices	Marcel Dekker	Inc., NY, USA	
2	Handbook of Food Products Manufacturing: Principles, Bakery, Beverages, Cereals	Y.H. Hui		2007
3	Chemistry and Technology of Soft Drinks and Fruit Juices	Philip R. Ashurst	Blackwell Publishing Ltd., Oxford, UK	2nd Ed., 2003
4	Handbook of Brewing: Processes, Technology, Markets	Hans Michael Eblinger	Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim. Germany	2009

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT621
Course Title: Processing Technology of Beverages

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Gain proficiency in the application of different processing techniques, including pasteurization, fermentation, carbonation, and blending, based on the type of beverage.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO:2 Understand the selection and quality assessment of raw materials such as fruits, grains, and water, considering their impact on the final product.	3	3	2	1	2	2	2	1	2	1	1	3	3	3	3	3
Develop an understanding of hygiene and sanitation	3	3	2	1	3	2	1	1	2	2	1	3	3	3	3	3

practices critical to preventing contamination during beverage processing.																
Implement quality control measures at various stages of production, including sensory evaluations and laboratory testing, to ensure product consistency and compliance with standards.	3	3	2	1	3	2	3	1	2	3	1	3	3	3	3	3
Acquire knowledge about production and processing of miscellaneous beverages.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Introduction to beverage	**SOs 1-5**	4	History and importance of beverages and status of beverage industry;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Beverage Processing	**SOs 1-5**	4	Processing of beverages: Packaged drinking water, juice based beverages, synthetic beverages, still, carbonated, low-calorie and dry beverages, isotonic and sports drinks, dairy based beverages, alcoholic beverages, fruit beverages, speciality beverages, tea, coffee, cocoa, spices, plant extracts, etc.;	
PO 1 to 12 and PSO 1 to 4	CO3: Comprehensive Insights into FSSAI Specifications.	**SOs 1-5**	4	FSSAI specifications for beverages; Ingredients, manufacturing and packaging processes and equipment for different beverages;	
PO 1 to 12 and PSO 1 to 4	CO4: Key Elements of Beverage Production.	**SOs 1-5**	4	Water treatment and quality of process water; Sweeteners, colorants, acidulants, clouding and clarifying and flavouring agents for beverages; Carbon dioxide and carbonation; Quality tests and control in beverages;	
PO 1 to 12 and PSO 1 to 4	CO5: Exploring the World of Miscellaneous Beverages	**SOs 1-5**	4	Miscellaneous beverages: Coconut water, sweet toddy, sugar cane juice, coconut milk, flavoured syrups.	

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester- VI

Course Code:	54FT628
Course Title :	Instrumentation and Process Control in Food Industry
Pre- requisite:	Students should have basic knowledge of electrical and electronics engineering along with the material science
Rationale:	The students studying B Tech (Food Technology) should possess basic understanding about the installation, maintenance, Data acquisition, Processing of data and interpretation of technical data during the day to day operation of food manufacturing plant, this subject will enhance their ability to work with data logger, SCADA system and other electronic devices to control the operational parameter in food manufacturing plant.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT628.1	Acquire the knowledge about fundamental of instrumentation and measurement
54FT628.2	Understanding the various engineering parameter, Various instruments and Control system used in food industry
54FT628.3	Understanding the process control in instrumentation and measurement
54FT628.4	Familiarize with the various Transducers elements and controllers
54FT628.5	Understanding the working of Computer-based monitoring and control system in food processing.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT628	Instrumentation and Process Control in Food Industry	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT628	Instrumentation and Process Control in Food Industry	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT628.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1.1 Understanding the fundamental of instrumentation and measurement SO1.2 Learning about Static and dynamic characteristics; Temperature and temperature scales; SO1.3 Acquire the knowledge about Pressure and pressure scales, manometers, pressure elements differential pressure; SO1.4 Understanding the system of Liquid level measurement	1.Study on instrumentation symbols 2.Determination of relative humidity by wet and dry bulb thermometer;	1. Introduction, definitions, 2. characteristics of instruments, 3. Static and dynamic characteristics; 4. Temperature scales; and temperature 5. Pressure and pressure scales, manometers, pressure elements differential pressure; 6. Liquid level measurement, different methods of liquid level measurement;	Study on fundamental of instrumentation and measurement

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT628.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1 Understanding about the working principle of Flow measurement device used in food industry SO2.2 Understanding about the working principle of Weight measurement device SO2.3 Understanding about the working principle of Measurement of moisture content, specific gravity, measurement of humidity, SO2.4 Acquire the knowledge about various scientific and engineering parameter used in food engineering operations SO2.5 Familiar with the Transmission: Pneumatic and electrical; Control elements, control actions, pneumatic and electrical control	1.Measurement of wind velocity by anemometer; 2.Measurement of intensity of sun shine by sunshine recorders;	1.Flow measurement: Kinds of flow, rate of flow, total flow 2. differential pressure meters, variable area meters, food flow metering; 3.Weight measurement: Mechanical scale, electronic tank scale, conveyor scale; 4.Measurement of moisture content, Specific gravity, measurement of humidity, 5.Measurement of viscosity, turbidity, color, measurement of density, brix, pH, enzyme sensors, automatic valves; 6.Transmission: Pneumatic and electrical; Control elements, control actions, pneumatic and electrical control systems;	Study on Different measuring devices used in food industry

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT628.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1 Understanding about Process control: Definition, simple system analysis SO3.2 Acquire the knowledge about Dynamic behaviour of simple process SO3.3 Understanding about the function of various Process control hardware SO3.4 Learning about the basics of frequency reponse analysis SO3.5 Understanding about the Bode diagram and Nyquist plots and stability analysis	1.Study of characteristics of pressure transducers, 2.Real-time study of pressure transducers characteristics with PC;	1.Process control: Definition, simple system analysis 2.Dynamic behaviour of simple process, Laplace transform, 3.process control hardware 4.Frequency response analysis, frequency response characteristics, 5.Bode diagram 6.Nyquist plots and stability analysis	Detail notes on Frequency response analysis

SW-3 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT628.4

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding about various transducer SO4.2 Acquire the knowledge about working of Self-generating transducers, variable parameter type, digital, actuating and controlling devices SO4.3 Understanding the working principle of Controllers and indicators: Temperature control, electronic controllers, flow ratio control SO4.4 Learning of functional attributes of atmosphere control, timers and indicators, food sorting and grading control, discrete controllers, SO4.5 Acquire the knowledge about working of adaptive and intelligent controllers	1-Characteristics of IC temperature sensor 2-Characteristics of platinum RTD	1. Transducers: Classification Self-generating transducers, variable parameter type, 2. digital, actuating and controlling devices 3. Controllers and indicators: Temperature control, electronic controllers, flow ratio control, 4. atmosphere control, timers and indicators, 5. food sorting and grading control, discretecontrollers, 6. adaptive and intelligent controllers;	Detail notes on Controllers and indicators

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):
Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT628.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	6	4	1	1	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO5.1 Knowledge about Introduction of Computer-based monitoring and control SO5.2 Knowledge about Importance of Computer-based monitoring and control SO5.3 Learning about the working and function of Hardware features of data acquisition and control SO5.4 Understanding about the computer signal interfacing, SO5.5 Learning of instrumentation and process control system in food industry with suitable examples in food processing related to the Computer-based monitoring and control	1.Temperature controlled alarm system 2.Study of water level to current conversion	1. Introduction Computer-based monitoring and control 2. Importance of Computer-based monitoring and control 3. Hardware features of data acquisition and control 4. computer signal interfacing, 5. examples in food processing related to the Computer-based monitoring and control 6. Application of computer based monitoring and control	Study about Data logger System in food manufacturing plant

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Note:

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Instructions (CI)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CI+ LI + SW + SL)
54FT628.1: Acquire the knowledge about fundamental of instrumentation and measurement	6	4	1	1	12
54FT628.2: Understanding the various engineering parameter, Various instruments and Control system used in food industry	6	4	1	1	12
54FT628.3: Understanding the process control in instrumentation and measurement	6	4	1	1	12
54FT628.4: Familiarize with the various Transducers elements and controllers	6	4	1	1	12
54FT628.5: Understanding the working of Computer-based monitoring and control system in food processing.	6	4	1	1	12
Total Hours	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Acquire the knowledge about fundamental of instrumentation and measurement	05	03	02	10
CO-2	Understanding the various engineering parameter, Various instruments and Control system used in food industry	02	03	05	10
CO-3	Understanding the process control in instrumentation and measurement	02	03	05	10
CO-4	Familiarize with the various Transducers elements and controllers	02	03	05	10
CO-5	Understanding the working of Computer-based monitoring and control system in food processing.	03	05	02	10
Total		14	17	19	50

Legend: R: Remember, U: Understand, A: Apply
The end of semester assessment for Instrumentation and Process Control in Food Industry will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Perry's Chemical Engineers' Handbook.	Don W. Green and Robert H. Perry.	McGraw-Hill Co., Inc., NY, USA.	2008.
2	Instrument Engineer's Handbook	Bela G. Liptak.	CRC Press, Boca Raton, FL, USA.	Vol. I and II, 2003. 4th Ed.
3	Process Control Instrumentation Technology,	Curtis D. Johnson.	Prentice Hall of India Pvt. Ltd., New Delhi.	7th Ed. 2003.
4	Transducers and Instrumentation.	D.V.S. Murty.	Prentice-Hall of India Pvt. Ltd. New Delhi.	2004.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT628
Course Title: Instrumentation and Process Control in Food Industry

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO1 Acquire the knowledge about fundamental of instrumentation and measurement	3	3	2	2	2	1	1	1	1	1	1	3	3	3	3	2
CO2 Understanding the various engineering parameter, Various instruments and Control system used in food	3	2	2	3	3	1	1	1	1	1	1	2	3	3	3	2

industry																
CO3 Understanding the process control in instrumentation and measurement	3	2	3	3	3	1	1	1	1	1	1	3	3	3	3	2
CO4 Familiarize with the various Transducers elements and controllers	2	3	3	3	3	1	1	1	1	1	1	3	3	3	3	2
CO5 Understanding the working of Computer-based monitoring and control system in food processing.	3	3	2	2	2	1	1	1	1	1	1	3	3	3	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Acquire the knowledge about fundamental of instrumentation and measurement	**SOs 1-5**	4	Introduction, definitions, characteristics of instruments, static and dynamic characteristics; Temperature and temperature scales; Various types of thermometers; thermocouples, resistance thermometers and pyrometers; Pressure and pressure scales, manometers, pressure elements differential pressure; Liquid level measurement, different methods of liquid level measurement;	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Understanding the various engineering parameter, Various instruments and Control system used in food industry	**SOs 1-5**	4	Flow measurement: Kinds of flow, rate of flow, total flow differential pressure meters, variable area meters, food flow metering; Weight measurement: Mechanical scale, electronic tank scale, conveyor scale; Measurement of moisture content, specific gravity, measurement of humidity, measurement of viscosity, turbidity, color, measurement of density, brix, pH, enzyme sensors, automatic valves; Transmission: Pneumatic and electrical; Control elements, control actions, pneumatic and electrical control systems;	
PO 1 to 12 and PSO 1 to 4	CO3: Understanding the process control in instrumentation and measurement	**SOs 1-5**	4	Process control: Definition, simple system analysis, dynamic behaviour of simple process, Laplace transform, process control hardware; Frequency response analysis, frequency response characteristics, Bode diagram and Nyquist plots and stability analysis;	
PO 1 to 12 and PSO 1 to 4	CO4: Familiarize with the various Transducers elements and controllers	**SOs 1-5**	4	Transducers: Classification, self-generating transducers, variable parameter type, digital, actuating and controlling devices; Controllers and indicators: Temperature control, electronic controllers, flow ratio control, atmosphere control, timers and indicators, food sorting and grading control, discrete controllers, adaptive and intelligent controllers;	
PO 1 to 12 and PSO 1 to 4	CO5: Understanding the working of Computer-based monitoring and control system in	**SOs 1-5**	4	Computer-based monitoring and control: Importance, hardware features of data acquisition and control computer, signal interfacing, examples in food processing.	

	food processing.				

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-VI

Course Code:	54FT679
Course Title :	Skill Development (Milk and Milk Products)- Lab
Pre- requisite:	Students should have basic knowledge of milk and milk products including with different types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing of various milk and milk products. They have to develop employability skills, intellectual skills, core of key skills and personal attributes with full responsibility and self-confidence.
Rationale:	The students studying Food Technology should possess foundational understanding about milk and milk products including with their processing, packaging and storage conditions.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT679.1	Ability to develop employability skills in the field of milk and milk processing.
54FT679.2	Ability to enhance technical knowledge and skills in the field of milk and milk processing.
54FT679.3	Ability to assess the quality of milk and milk products.
54FT679.4	Ability to recall the standards and regulations of milk and milk processing industries.
54FT679.5	Ability to demonstrate skills in milk and milk processing industries.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT679	Skill Development (Milk and Milk Products)- Lab	0	4	0	0	0	2

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		End Semester Practical Exam (ESPE) (Viva-Voce+Record)
			Viva Voce	Record	
PCFT	54FT679	Skill Development (Milk and Milk Products)- Lab	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment

The end of semester assessment, the student will be required to prepare a detailed Project Report on Skill Development (Milk and Milk Products). The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Making Project Report and Power Point Presentation on the same skill.
2. Take guidance of concerned teacher that assigned for the same subject.

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT679
Course Title: Skill Development (Milk and Milk Products)-Lab

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Ability to develop employability skills in the field of milk and milk processing.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:2 Ability to enhance technical knowledge and skills in the field of milk and milk processing.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3

CO:3 Ability to assess the quality of milk and milk products.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:4 Ability to recall the standards and regulations of milk and milk processing industries.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO:5 Ability to demonstrate skills in milk and milk processing industries.	3	2	2	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Ability to develop employability skills in the field of milk and milk processing.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO2: Ability to enhance technical knowledge and skills in the field of milk and milk processing	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO3: Ability to assess the quality of milk and milk products.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO4: Ability to recall the standards and regulations of milk and milk processing industries.	**SOs 1-5**			
PO 1 to 12 and PSO 1 to 4	CO5: Ability to demonstrate skills in milk and milk processing industries.	**SOs 1-5**			

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Semester-IV

Course Code:	54FT625
Course Title :	Sensory Evaluation of Food Products
Pre- requisite:	A foundational understanding of sensory perception principles and familiarity with basic taste, aroma, and texture attributes in diverse food categories. Participants should also possess knowledge of experimental design and statistical analysis techniques relevant to sensory testing.
Rationale:	Sensory evaluation of food products is crucial to assess and optimize their organoleptic qualities, ensuring alignment with consumer preferences. This process provides valuable insights into flavor, texture, and appearance, guiding product development, quality improvement, and market success.

Course Outcomes (CO):

Course Code	Course Outcomes
54FT625.1	Gain a comprehensive understanding of the principles underlying sensory evaluation, including the human sensory system, perception mechanisms, and psychological factors influencing taste, smell, texture, and appearance.
54FT625.2	Learn various sensory evaluation methodologies and testing techniques used in the food industry, including discrimination tests, descriptive analysis, consumer testing, and preference mapping.
54FT625.3	Acquire knowledge of experimental design principles and statistical analysis techniques relevant to sensory testing, ensuring the validity and reliability of sensory evaluations.
54FT625.4	Explore the correlation between sensory attributes and consumer preferences. Understand how sensory evaluations influence product development, marketing strategies, and the overall success of food products in the market.
54FT625.5	Gain skills in managing sensory panels, including panel selection, training, and monitoring. Understand the importance of panel consistency and reliability in obtaining accurate sensory data.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT625	Sensory Evaluation of food products	2	2	1	1	6	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),
- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Course category	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment		End Semester Practical Assessment (ESPA)	End Semester Exam (ESE)	Total Marks (SA1+SA2 +ESPA+ESE)
			SA 1	SA2			
PCFT	54FT 625	Sensory Evaluation of food products	15	15	20	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT625.1:

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-1	Self Learning (SL)
SO1: To Comprehend the fundamental concepts of sensory evaluation, including its introduction, definition, and significance in shaping consumer acceptability and influencing economic aspects within the food industry. SO2: To Explore the diverse factors that impact food acceptance, ranging from sensory attributes like taste, aroma, and texture to external factors such as cultural, social, and psychological influences. SO3: To Gain insights into the principles of good practice in sensory evaluation, covering the creation of an optimal sensory testing environment and the formulation of effective test protocols. SO4: To Understand the critical elements of a conducive sensory testing environment, including considerations for controlled conditions, unbiased testing spaces, and factors that influence sensory perception. SO5: Examine essential considerations when developing sensory test protocols, encompassing factors such as experimental design, sample presentation, and statistical analysis techniques to ensure the reliability and validity of results.	1. To understand the principles of good practice in sensory evaluation, including the sensory testing environment and test protocol considerations. 2. To explore and understand the various factors that influence food acceptance.	1.1 Introduction, 1.2 definition and importance of sensory evaluation in relation: to consumer acceptability and economic aspects; 1.3 Factors affecting food acceptance. Terminology related to sensory evaluation. 1.4 Principles of good practice: the sensory testing environment 1.5 test protocol considerations	1. Reflective Practice

SW-1 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT625.2:

Items	CI	LI	SW	SL	Total
Approx. Hours	8	4	1	1	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-2	Self Learning (SL)
SO2.1: To Examine the physiology of sensory organs, delving into the mechanisms by which taste, smell, sight, hearing, and touch are processed and interpreted by the human body. SO2.2: To Explore the factors influencing sensory threshold values, considering variables such as individual differences, adaptation, and environmental conditions that affect the perception of sensory stimuli. SO2.3: To Examine the sensory responses beyond taste and smell, including visual, auditory, tactile, and other sensory modalities. Understand how these responses contribute to the overall perception of a product. SO2.4: To Differentiate between various types of discrimination tests, such as paired comparison, duo-trio, triangle tests, ranking, scoring, hedonic scales, and descriptive tests. Understand when each type is appropriate for specific evaluations. SO2.5: To Gain proficiency in descriptive tests, which involve detailed evaluations of sensory attributes. Understand how to use descriptive tests to characterize and quantify specific qualities in a product.	1. To conduct hedonic scale and descriptive tests. 2. To understand and conduct a triangle discrimination test	2.1. Basic principles 2.2 Senses and sensory perception, 2.3 Physiology of sensory organs, 2.4 Classification of tastes and odours, 2.5 threshold value factors affecting senses, visual, auditory, tactile and other responses. 2.6 Discrimination Tests, 2.7 Procedure: Types of tests – difference tests (Paired comparison, due-trio, triangle) ranking, scoring, 2.8 Hedonic scale and descriptive tests	Difference tests

SW-2 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT625.3:

Items	CI	LI	SW	SL	Total
Approx. Hours	9	4	1	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-3	Self Learning (SL)
SO3.1: To Understand the criteria for selecting panel members for sensory evaluation. Learn the importance of screening to ensure that panelists possess the necessary sensory acuity and reliability. SO3.2. To Explore the essential requirements for effective sensory evaluation, including proper facilities, controlled testing environments, calibrated equipment, and adherence to standardized procedures. SO3.3: To Learn the principles of sampling in sensory evaluation. Understand how samples are selected, prepared, and presented to ensure representative and unbiased evaluations. SO3.4: To Understand the objectives of consumer research in the context of sensory evaluation. Explore how consumer preferences and perceptions impact product development and marketing strategies. SO3.5: To Gain an overview of affective tests in sensory evaluation. Understand how these tests measure emotional responses, liking, and overall preferences of consumers towards products.	1. To explore and understand the various factors that can influence sensory measurements. 2. To demonstrate the importance of meeting specific requirements in sensory evaluation and understanding sampling procedures.	3.1 Understanding the Panel Selection, 3..2 Screening 3.3 Training of Judges 3.4 Panel selection, 3.5 screening and training of judges; 3.6 Requirements of sensory evaluation, sampling procedures; 3.7 Factors influencing sensory measurements; 3.8 Consumer Research 3.9 Affective Tests: Objectives.	Investigate the criteria for selecting sensory panelists.

SW-3 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT625.4

Items	CI	LI	SW	SL	Total
Approx. Hours	5	4	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 To gain knowledge of various types of questionnaires used in sensory research, such as profiling questionnaires and preference scales SO4.2 To Able to develop effective sensory evaluation questionnaires tailored to specific research objectives. SO4.3 To Analyze the strengths and limitations of laboratory testing in contrast to consumer studies. SO4.4 To Explore case studies highlighting successful integration of sensory and instrumental analysis in food research. SO4.5 To enhance their ability to interpret data from both sensory and instrumental analyses.	The interrelationship between sensory properties and instrumental/physic o-chemical tests. To compare the outcomes of laboratory testing and consumer studies for a specific food product.	4.1. Methods, types or questionnaires, 4.2 development of questionnaires, 4.3 laboratory testing 1.4 Consumer studies, limitations. 4.5 Interrelationship between sensory properties of food products various instrumental Physico-chemical tests;	Case studies

SW-4 Suggested Sessional Work (SW):
Assignments:
Mini Project:
Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

54FT625.5:

Items	CI	LI	SW	SL	Total
Approx. Hours	3	4	1	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-5	Self Learning (SL)
SO1: To understand the role of sensory evaluation in the various stages of food product development. SO2. To earn the fundamental principles of conducting sensory testing for product development. SO3: To learn strategies for optimizing sensory properties based on consumer feedback and sensory analysis. SO4: To understand the role of sensory panels in quality control, including panel selection and training. SO5: Introduced to statistical methods used in sensory quality control.	1. To assess consumer preferences for a particular food product. 2. To determine if there are perceptible differences between two or more product samples.	5.1 Sensory evaluation and quality control 5.2 Quality Evaluations Application of sensory testing: 5.3 sensory evaluation in food product development, sensory evaluation in quality control.	Case Studies

SW-5 Suggested Sessional Work (SW):

a. Assignments:
b. Mini Project:
c. Other Activities (Specify):

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Lab Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+ LI + SW + SL)
54FT625.1 Gain a comprehensive understanding of the principles underlying sensory evaluation, including the human sensory system, perception mechanisms, and psychological factors influencing taste, smell, texture, and appearance.	5	4	1	1	11
54FT625.2 Learn various sensory evaluation methodologies and testing techniques used in the food industry, including discrimination tests, descriptive analysis, consumer testing, and preference mapping.	8	4	1	1	14
54FT625.3 Acquire knowledge of experimental design principles and statistical analysis techniques relevant to sensory testing, ensuring the validity and reliability of sensory evaluations.	9	4	1	1	15
54FT625.4 Explore the correlation between sensory attributes and consumer preferences. Understand how sensory evaluations influence product development, marketing strategies, and the overall success of food products in the market.	5	4	1	1	11
54FT625.5 Gain skills in managing sensory panels, including panel selection, training, and monitoring. Understand the importance of panel consistency and reliability in obtaining accurate sensory data.	3	4	1	1	9
Total	30	20	5	5	60

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggestion for End Semester Assessment
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to sensory evaluation of food products.	3	5	2	10
CO-2	Senses and sensory perception	2	5	3	10
CO-3	Understanding the Panel Selection, Screening, and Training of Judges	3	5	2	10
CO-4	Questionnaires	2	5	3	10
CO-5	Sensory evaluation and quality control	3	5	2	10
Total		13	25	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Sensory Evaluation of Food Products will be held with written examination of 50 marks.
Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.
Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture and Tutorial
2. Case Method
3. Group Discussion and Role Play
4. Visit to food plant
5. Demonstration
6. ICT Based Teaching Learning
7. Brainstorming

AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

Suggested Learning Resources

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Principles of Sensory Evaluation of Food	Amerine, M.A., Pangborn, R.M. and Rossles, E.B	Academic Press, London	1965
2	Guide to Quality Management Systems for Food Industries	Early, R	Blackie Academic	1995
3	Sensory Evaluation of Foods	Piggot, J.R.	Elbview Applied Science Publ.	1984
4	Evaluation of Food: Principles and Practices	Harry, T. Lawless, Hildegarde Heymann	Springer, New York or Dordrecht Heidelberg, London	2010, 2nd Ed

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AKS University, Satna
Faculty of Agriculture Science & Technology
Department of Agriculture Engineering and Food Technology
Curriculum of B.Tech. (Food Technology) Program
(Revised as on 01 August 2023)

CO, Pos and PSOs Mapping

Course Title: B. Tech (Food Technology)
Course Code: 54FT625
Course Title: Sensory Evaluation of Food Products

Course Outcomes	Program Outcomes												Program Specific Outcome			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
	Engineering knowledge	Problem analysis	Design / development of Solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustain ability	Ethics	Individual and team work	Communication	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacturing	Ability to understand the day to plant operational problems of food manufacturing and food Packaging	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO:1 Gain a comprehensive understanding of the principles underlying sensory evaluation, including the human sensory system, perception mechanisms, and	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	2

psychological factors influencing taste, smell, texture, and appearance.																
CO:2 Learn various sensory evaluation methodologies and testing techniques used in the food industry, including discrimination tests, descriptive analysis, consumer testing, and preference mapping.	1	1	2	2	1	2	3	1	2	1	1	3	3	3	3	3
CO:3 Acquire knowledge of experimental design principles and statistical analysis techniques relevant to sensory testing, ensuring the validity and reliability of sensory evaluations.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO:4 Explore the correlation between sensory attributes and consumer preferences. Understand how sensory evaluations influence product	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3

development, marketing strategies, and the overall success of food products in the market.																
CO:5 Gain skills in managing sensory panels, including panel selection, training, and monitoring. Understand the importance of panel consistency and reliability in obtaining accurate sensory data.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

POs & PSOs No.	COs No.& Titles	SOs No.	LI	Classroom Instruction(CI)	Self Learning
PO 1 to 12 and PSO 1 to 4	CO1: Introduction to sensory evaluation of food products	**SOs 1-5**	4	Introduction, definition and importance of sensory evaluation in relation: to consumer acceptability and economic aspects; factors affecting food acceptance. Terminology related to sensory evaluation. Principles of good practice: the sensory testing environment, test protocol considerations,	**As mentioned in page number 3 to 7**
PO 1 to 12 and PSO 1 to 4	CO2: Senses and sensory perception	**SOs 1-5**	4	Basic principles: Senses and sensory perception, Physiology of sensory organs, Classification of tastes and odours, threshold value factors affecting senses, visual, auditory, tactile and other responses. Discrimination Tests, Procedure: Types of tests – difference tests (Paired comparison, due-trio, triangle) ranking, scoring, Hedonic scale and descriptive tests.	
PO 1 to 12 and PSO 1 to 4	CO3: Panel selection	**SOs 1-5**	4	Panel selection, screening and training of judges; Requirements of sensory evaluation, sampling procedures; Factors influencing sensory measurements; Consumer Research – Affective Tests: Objectives.	
PO 1 to 12 and PSO 1 to 4	CO4: Questionnaires	**SOs 1-5**	4	Methods, types or questionnaires, development of questionnaires, comparison of laboratory testing and Consumers studies, limitations. Interrelationship between sensory properties of food products and various instrumental and physico-chemical tests;	
PO 1 to 12 and PSO 1 to 4	CO5: Relation between sensory and quality	**SOs 1-5**	4	Quality Evaluations Application of sensory testing: sensory evaluation in food product development, sensory evaluation in quality control.	

Semester-VII

Course Code: 54FT722-D

Course Title : Food Laws and regulations

Pre- requisite:

Professionals in the food industry must have a foundational understanding of food law and regulations. This includes knowledge of international, national, and regional legal frameworks, regulatory bodies, and food safety standards. Additionally, familiarity with labeling requirements, quality standards, hygiene practices, and import/export regulations is crucial. Professionals should stay informed about emerging issues, consumer protection laws, and the consequences of non-compliance. Maintaining meticulous documentation and record-keeping practices is essential for ensuring adherence to regulations and upholding the safety and quality of food products.

Rationale:

Food law and regulation are instituted to safeguard public health, ensure food safety, and maintain fair trade practices. They foster transparency through accurate labeling, protecting consumers from fraudulent practices. These frameworks address environmental and ethical considerations, promoting sustainability and responsible food production. Facilitating international trade, they harmonize standards to protect consumers globally. Importantly, food regulations act as a deterrent, promoting legal adherence and swift response mechanisms to emergencies in the food industry.

Course Outcomes:

54FT722-D.1: Apply knowledge of food laws and regulations to assess and address real-world scenarios related to food safety, labeling, and fair trade practices.

54FT722-D.2: Conduct critical analyses of the impact of food regulations on consumer protection, market integrity, and ethical considerations within the food industry.

54FT722-D.3: Demonstrate a solid understanding of the legal frameworks governing the food industry at local, national, and international levels.

54FT722-D.4: Develop skills in identifying and managing risks associated with food production and distribution, considering potential hazards and regulatory requirements.

54FT722-D: Recognize how food laws adapt to technological advancements and emerging trends, demonstrating an understanding of innovation and adaptation in the industry.

Scheme of studies								
Course category	**Course Code**	**Course Title**	**Cl**	**LI**	**SW**	**SL**	**Total study hours (CL+LI +SW+SL)**	**Total credits(C)**
PCFT	54FT722-D	Food Laws & Regulations	3		1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture
(L) and Tutorial(T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C:Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teachers to ensure the outcome of Learning.

Scheme of Assessment:

Course category	Couse Code	Course Title	Scheme of Assessment (Marks)			End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Progressive Assessment (PRA)				
			Sessional Assessments		Internal Assessment		
			SA1	SA2			
PCFT	54FT722-D	Food Laws & Regulations	20	20	10	50	100

Theory:

This course provides a comprehensive exploration of the legal frameworks governing the food industry. Students will gain in-depth knowledge of international, national, and regional regulations, focusing on key aspects such as food safety, labeling, quality standards, and ethical considerations. Practical applications of legal principles, compliance management, and emerging issues in the dynamic field of food laws will be emphasized.

54FT722-D.1:

Session Outcomes (SOs)	Laboratory Instruction(LI)	Classroom Instruction (CL)	Self Learning (SL)
SO1. To Recognize the crucial role of compliance with food laws in ensuring the safety, quality, and fairness of the food supply chain. **SO2.** To Understand how the enforcement of food laws is integral to safeguarding public health by preventing foodborne illnesses		**Unit1-** 1-Introduction to subject, 2-Need of enforcing the laws and various types of laws(Part-1) 3-Need of enforcing the laws and various types of laws(Part-2) 4-Need of enforcing the laws and various types of laws(Part-3)	1-Study on PFA

and ensuring the consumption of safe food. **SO3**. To Understand the categorization of food laws, including those related to safety, labeling, quality standards, and ethical considerations and to Recognizing the significance of local and regional regulations in addressing specific needs and challenges within diverse geographical contexts. **SO4.** To Identify and understand mandatory food laws that have a direct impact on the production, distribution, and sale of food products. **SO5.**To Familiarize with the key provisions of the bill, including its objectives, structure, and the establishment of the Food Safety and Standards Authority of India (FSSAI).		5-Mandatory food laws(Part-1) 6- Mandatory food laws(Part-2) 7-The food safety and standards bill 2005(Part-1) 8- The food safety and standards bill 2005(Part-1)	

a. Assignments:

1. Explore the historical and contemporary significance of The Food Safety and Standards Bill 2005.

Approximate Hours

Item	CL	LI	S W	SL	Total
Approximate Hours	**9**	**0**	**1**	**1**	**11**

54FT722-D.2:

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)

SO1: To Gain insights into the specific role and functions of the Chief Executive Officer within the regulatory framework, understanding their responsibilities in overseeing and implementing food safety standards. SO2: To Acquire a strong foundation in the scientific aspects of food safety, including the principles of food analysis, risk assessment, and the integration of scientific knowledge into regulatory decision-making. SO3: To Understand the general principles governing the administration of the Food Safety and Standards Act, covering legal and procedural aspects of enforcement, compliance, and regulatory oversight. SO4: To Develop proficiency in interpreting and applying general provisions related to articles of food, encompassing labeling requirements, quality standards, and other essential criteria for ensuring consumer safety and information. SO5: To Recognize the special responsibilities of regulatory authorities and food businesses in ensuring the safety of food products, including the formulation and implementation of safety standards.		**Unit 2:** Understanding the authorities 1- Establishment of the authority, 2- Composition of authoring functions of chief executive officer, scientific (Part-1) 3-Composition of authoring functions of chief executive officer, scientific (Part-2) 4- General principles to be followed in administration of act(Part-1) 5- General principles to be followed in administration of act(Part-2) 6- General provisions as to articles of food(Part-1) 7- General provisions as to articles of food(Part-2) 8- special responsibility as to safety of food, 9-Analysis of food offenses of penalties.	1-List of current authorities of FSSAI

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Comparison of Difference Tests, Case Study on Sensory Testing in Industry, Design a hedonic scale for a specific food product. Include descriptors ranging from extremely disliked to extremely liked. Conduct a hedonic evaluation and interpret the results.

Approximate Hours

Item	CL	LI	S W	S L	Total
Approximate Hours	**9**	**0**	**1**	**1**	**11**

54FT722-D.3:

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1: To Understand the primary objectives and purpose of the Act in safeguarding public health and ensuring the purity of food. SO2. To Identify the composition and functions of the Central Committee for Food Standards. SO3: To Understand the role and responsibilities of a food inspector in enforcing the provisions of the Act. SO4: To Analyze the significance of the report provided by a public analyst in determining the adulteration status of a food sample. SO5: To Analyze real-world cases related to the Prevention of Food Adulteration Act, discussing legal outcomes and implications.		**Unit 3. PFA** 3.1 Preventions of Food adulteration act; Definition, object of act, 3.2 central committee for food standards; 3.3 public analysis, food inspector, duties of Food inspectors, 3.4 Report of Public analyst, sealing, fastening and dispatch of samples, 3.5 powers of court. 3.6 Other Mandatory acts. 3.7 Standard weight of measure act	Case study

W-2 Suggested Sessional Work (SW):

Assignment:

1. Analyze the role and functions of the Central Committee for Food Standards

2. Explore the historical context that led to the formulation of the Prevention of Food Adulteration Act

Approximate Hours

Item	CL	LI	S W	S L	Total
Approximate Hours	**9**	**0**	**1**	**1**	**11**

54FT722-D.4:

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1. To Discuss the objectives of the Essential Commodities Act and its role in regulating the production, supply, and distribution of essential goods. SO2. To Understand the responsibilities of regulatory authorities in ensuring the availability and equitable distribution of essential commodities. SO3. To Explore the mechanisms for redressal of consumer grievances and the role of consumer forums. SO4. To Explore the role of regulatory bodies in enforcing environmental standards related to food production and processing. SO5. To Understand the objectives of the Insecticides Act in regulating the sale, distribution, and use of pesticides.		Unit 4. Other acts 4.1 essential commodity act, 4.2 consumer protection act, 4.3 Environmental protection act insecticide act. 4.4 Export (quality control & inspection) act. 4.5 Various food orders; 4.6 Fruit product order, 4.7 Milk & Milk product order, 4.8 plant food seed (Regulation of imports in India) order(Part-1 4.9 plant food seed 4.9 (Regulation of imports in India) order(Part-2)	1-Case studies on food safety in india

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Explore quality control measures for exported food products
2. Investigate the regulation of pesticides and insecticides in food products

Approximate Hours

Item	**AppX Hrs**
Cl	08
LI	0
SW	2
SL	1
Total	08

Course Outcomes	**Class Lecture (Cl)**	**Sessional Work (SW)**	**Self Learning (Sl)**	**Total hour (Cl+SW+Sl)**
CO1: To Apply knowledge of food laws and regulations to assess and address real-world scenarios related to food safety, labeling, and fair trade practices.	9	1	1	11
CO2: To Conduct critical analyses of the impact of food regulations on consumer protection, market integrity, and ethical considerations within the food industry.	9	1	1	11
CO3: To Demonstrate a solid understanding of the legal frameworks governing the food industry at local, national, and international levels.	9	1	1	11
CO4: To Develop skills in identifying and managing risks associated with food production and distribution, considering potential hazards and regulatory requirements.	9	1	1	11

CO5: To Recognize how food laws adapt to technological advancements and emerging trends, demonstrating an understanding of innovation and adaptation in the industry.	9	1	1	11
Total	45	5	5	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	**Unit Titles**	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO1	Introduction to subject,	03	05	02	10
CO2	understanding the authorities	02	05	03	10
CO3	PFA	03	05	02	10
CO4	Other acts	02	05	03	10
CO5	mandatory acts	03	05	02	10
Total		13	25	12	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Food laws and regulations will be held with written examination of 50 marks
Note. Detailed Assessment rubric needs to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Technology Integration in Assignments:
2. Quality Control Exercises:

3. Collaborative Industry Projects:
4. Continuous Assessment:
5. Professional Certifications:

Suggested Learning Resources:

(a) Books :

1. Food Safety and Standards Act 2006 Along With Rules 2011 by Commercial, Commercial Law Publishers India Pvt Ltd

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Cos,POs and PSOs Mapping

Course Title: B. Tech. Food Technology

Course Code : 54FT722-D

Course Title: Food laws and Standards

Course Outcomes	PO 1	PO2	PO 3	PO4	P O 5	PO 6	P O 7	P O 8	PO 9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
	Engine ering knowle dge	Prob lem anal ysis	Desig n/dev elop ment of soluti ons	Cond uct invest igatio ns of compl ex probl ems	Mode rn tool usage	The engi neer and soci ety	Environ ment and sustain ability:	Ethics	Indivi dual and team work:	Com munic ation:	Project manage ment and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacture.	Ability to understand the day to plant operational problems of food	Ability to understand the latest food manufacturin g technology.	Ability to use the research based innovative knowledge for SDGs
CO1: To Apply knowledge of food laws and regulations to assess and address real-world scenarios related to food safety, labeling, and fair trade practices.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	2	3

CO2: To Conduct critical analyses of the impact of food regulations on consumer protection, market integrity, and ethical considerations within the food industry.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	2
CO3: To Demonstrate a solid understanding of the legal frameworks governing the food industry at local, national, and international levels.	2	2	1	1	1	2	2	2	1	2	1	2	1	3	2	1
CO4: To Develop skills in identifying and managing risks associated with food production and distribution, considering potential hazards and regulatory requirements.	3	2	2	2	3	2	3	2	2	1	2	3	3	1	2	2
CO5: To Recognize how food laws adapt to technological advancements and emerging trends, demonstrating an understanding of innovation and adaptation in the industry.	-	-	-	1	1	3	3	3	1	1	2	2	3	2	1	2

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4, 5,6 7,8,9,10 ,11,12 PSO 1,2, 3, 4, 5	CO1: Apply knowledge of food laws and regulations to assess and address real-world scenarios related to food safety, labeling, and fair trade practices.	SO1. SO2 SO3 SO4 SO4		Unit 1.Introduction to subject, 1.1 Need of enforcing the laws and various types of laws. 1.2 Mandatory food laws; 1.3. The food safety and standards bill 2005	1. Reflective Practice 2. Terminology in Sensory Evaluation

PO 1,2,3,4, 5,6 7,8,9,10 ,11,12 PSO 1,2, 3, 4, 5	CO2: Conduct critical analyses of the impact of food regulations on consumer protection, market integrity, and ethical considerations within the food industry.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		UNIT 2: understanding the authorities 2.1. Establishment of the authority, 2.2 composition of authoring functions of chief executive officer, 2.3 scientific part, 2.4 General principles to be followed in administration of act, 2.5 General provisions as to articles of food, 2.6 special responsibility as to safety of food, 2.7 analysis of food offenses of penalties.	Explore Industry Reports

PO 1,2,3,4, 5,6 7,8,9,10 ,11,12 PSO 1,2, 3, 4, 5	CO3: Demonstrate a solid understanding of the legal frameworks governing the food industry at local, national, and international levels.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit 3. PFA 3.1 Preventions of Food adulteration act; Definition, object of act, 3.2 central committee for food standards; 3.3 public analysis, food inspector, duties of Food inspectors, 3.4 Report of Public analyst, sealing, fastening and dispatch of samples, 3.5 powers of court. 3.6 Other Mandatory acts. 3.7 Standard weight of measure act	Investigate the criteria for selecting sensory panelists.

PO 1,2,3,4, 5,6 7,8,9,10 ,11,12 PSO 1,2, 3, 4, 5	CO4: Develop skills in identifying and managing risks associated with food production and distribution, considering potential hazards and regulatory requirements.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	.	Unit 4. Other acts 4.1 essential commodity act, 4.2 consumer protection act, 4.3 Environmental protection act insecticide act. 4.4 Export (quality control & inspection) act. 4.5 Various food orders; 4.6 Fruit product order, 4.7 Milk & Milk product order, 4.8 plant food seed (Regulation of imports in India) order	1. Case studies 2. s

PO 1,2,3,4, 5,6 7,8,9,10 ,11,12 PSO 1,2, 3, 4, 5	CO5: Recognize how food laws adapt to technological advancements and emerging trends, demonstrating an understanding of innovation and adaptation in the industry.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5.mandatory acts 5.1 edible oil package order 5.2 meat food products order. 5.3 Optional food standards; Scope of these standards, their need, 5.4 procedure to obtain that standard, 5.5 Agmark, 5.6 Bureau of Indian Standards. 5.7 Codex Standards; Scope of codex standards, codex standards for cereals, pulses, fruit & vegetables, Meat & Poultry products, 5.8 Recommended international code of hygiene for various products.	Case Studies

Semester-VII

Course Code	54FT721
Course Title	Entrepreneurship Development
Pre-requisite	Students should have basic knowledge of Food Processing Sector and market demand.
Rationale	The purpose of this course is to cultivate students' understanding and knowledge of entrepreneurship. This course emphasizes the cultivation of students' motivation towards entrepreneurship. Greater emphasis is placed on creativity and innovation. The course aims to acquaint students with the diverse attributes necessary for entrepreneurship. Elucidate different entrepreneurship frameworks. Facilitate engagement with accomplished entrepreneurs and acquaint individuals with diverse tools such as the Six Hat Techniques.

Course Outcomes

54FT721.1: Describe the Importance, growth, characteristics and qualities of entrepreneur.
54FT721.2: Explain the basics of Entrepreneurships.
54FT721.3: Acquired the knowledge for SWOT analysis and Women Entrepreneurship.
54FT721.4: Explain the policies of establishment of Food Micro scale industry.
54FT721.5: Explain the Export import of Goods for Food Sector.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours	
Program Core (PCFT)	54FT721	Entrepreneurship Development	3	0	1	1	5	3

Legend

- **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
- **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
- **SW:** Sessional Work (includes assignment, seminar, mini project etc.),

- **SL:** Self Learning,
- **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment

Theory+ Practical:

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)				
			Progressive Assessment (PRA)			End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Sessional Assessments		Home Assessment		
			SA 1	SA 2			
PCFT	54FT721	Entrepreneurship Development	20	20	10	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

54FT721.1: Describe the Importance, growth, characteristics and qualities of entrepreneur.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	9	0	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand structure of		**Unit 1** 1- Entrepreneurship:	Knowledge about Food 1-1-1

Entrepreneurship SO1.2 Understand Role of entrepreneurship SO1.3 Understanding the Entrepreneurship development SO1.4 Understanding the Overview of Indian social, political and economic systems SO1.5 Understanding the Globalization and the emerging Entrepreneurships.		Importance and growth, characteristics and qualities of entrepreneur 2- Role of entrepreneurship, ethics and social responsibilities 3- Entrepreneurship development: Assessing overall business environment in the Indian economy; 4-Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs(Part-1) 5-Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs(Part-2) 6-Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs(Part-3) 7--Globalization and the emerging business/entrepreneurial environment(Part-1) 8- Globalization and the emerging business/entrepreneurial environment(Part-2) 9-Globalization and the emerging business/entrepreneurial environment(Part-3)	Study on Entrepreneurship opportunities in Food Industry

54FT721.2: Explain the basics of Entrepreneurships.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	9	0	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand Concept of entrepreneurship SO2.2 Understand managerial characteristics SO2.3 Understanding Managing an enterprise SO2.4 Understanding Motivation and entrepreneurship development SO2.5 Understanding managing competition, entrepreneurship development programs.		**Unit 2** 1-Concept of entrepreneurship 2- Entrepreneurial and managerial characteristics 3-Managing an enterprise 4-Motivation and entrepreneurship development(Part-1) 5-Motivation and entrepreneurship development(Part-2) 6-Motivation and entrepreneurship development(Part-3) 7-Importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs(Part-1) 8-Importance of planning, monitoring, evaluation and follow up, managing competition,	Knowledge about Food Entrepreneurship

		entrepreneurship development programs(Part-2) 9-Importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs(Part-3)	

54FT721.3: Acquired the knowledge for SWOT analysis and Women Entrepreneurship.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	9	0	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand SWOT analysis SO3.2 Understand Commercialization of ideas and innovations SO3.3 Understanding Women entrepreneurships SO3.4. Understand the Corporate entrepreneurship SO3.5.Understanding the Role, mobility of entrepreneur		**Unit 3** 1- SWOT analysis(Part-1) 2- SWOT analysis(Part-2) 3- SWOT analysis(Part-3) 4- Generation, incubation and commercialization of ideas and innovations 5- Women entrepreneursh 6- : Role and importance, problems 7- Corporate entrepreneurship 8- Role, mobility of	Knowledge about Food Entrepreneurship

		entrepreneur(Part-1) 9- Role, mobility of entrepreneur(Part-2)	

54FT721.4: Explain the policies of establishment of Food Micro scale industry.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	9	0	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1. Understanding the Entrepreneurial motivation SO4.2. Explain the Planning and evaluation of projects SO4.3. Project feasibility study SO4.4. New venture management; Creativity. SO4.5. Government schemes and incentives for entrepreneurship		**Unit 4** 1-Entrepreneurial motivation(Part-1) 2-Entrepreneurial motivation(Part-2) 3-Planning and evaluation of projects: Growth of firm, project identification and selection, factors inducing growth(Part-1) 4-Planning and evaluation of projects: Growth of firm, project identification and selection, factors inducing growth(Part-2) 5-Project feasibility study: Post planning of project, project planning and control 6-New venture management; Creativity. 7-Government schemes and incentives for promotion of entrepreneurship(Part-1)	Knowledge about Food Entrepreneurship

		8-Government schemes and incentives for promotion of entrepreneurship(Part-2) 9-Government policy on small and medium enterprises (SMEs)/SSIs(Part-3)	

54FT721.5: Explain the Export import of Goods for Food Sector.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	9	0	1	1	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1. Understanding the Export and import policies SO5.2. Understanding the Venture capital Contract farming and joint ventures SO5.3. Public-private partnerships SO5.4. Overview of food industry inputs SO5.5. Characteristics of Indian food processing industries and export		**Unit 5** 1- Export and import policies relevant to food processing sector(Part-1) 2- Export and import policies relevant to food processing sector(Part-2) 3- Export and import policies relevant to food processing sector(Part-3) 4-Venture capital Contract farming and joint ventures 5-Public-private partnerships 6-Overview of food industry inputs 7-Characteristics of Indian food processing industries and export(Part-1) 8-Characteristics of Indian food processing industries and export(Part-2) 9-Social responsibility of	Knowledge about Food Entrepreneurship

		business	

Brief of Hours suggested for the Course Outcome

Course Outcomes	CL	LI	SW	SL	Total hour (Cl+L1+SW+SL)
54FT721.1: Describe the Importance, growth, characteristics and qualities of entrepreneur.	9	0	1	1	11
54FT721.2: Explain the basics of Entrepreneurships.	9	0	1	1	11
54FT721.3: Acquired the knowledge for SWOT analysis and Women Entrepreneurship.	9	0	1	1	11
54FT721.4: Explain the policies of establishment of Food Micro scale industry.	9	0	1	1	11
54FT721.5: Explain the Export import of Goods for Food Sector.	9	0	1	1	11
Total Hours	**45**	**0**	**5**	**5**	**55**

Suggestion for End Semester Assessment Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Importance, growth, characteristics and qualities of entrepreneur.	03	02	01	06
CO-2	Basics of Entrepreneurships.	03	05	03	11
CO-3	SWOT analysis and Women Entrepreneurship.	03	05	03	11
CO-4	Policies of establishment of Food Micro scale industry.	03	05	03	11
CO-5	Export import of Goods for Food Sector.	03	03	05	11
		15	20	15	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Entrepreneurship Development (Theory) will be held with written examination of 50 marks.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

- Improved Lecture and Tutorial
- Case Method
- Group Discussion and Role Play
- Visit to food plant
- ICT Based Teaching Learning
- Brainstorming

Suggested Learning Resources:

Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Entrepreneurship Development	C.B. Gupta and N.P. Srinivasan	S. Chand & Sons, New Delhi	2012
2	Entrepreneurship Development	Anil Kumar, S., Poornima, S.C., Mini, K., Abraham and Jayashree, K.	New Age International Publishers, New Delhi	2003
3	Management: Theory and Practice	Gupta, C.B	Sultan Chand & Sons, New Delhi.	2001

Curriculum Development Team

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3. Er. Gyan Prakash, Assistant Professor, Department of Food Technology
4. Er. Devendra pandey, Assistant Professor, Department of Food Technology
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Cos, POs and PSOs Mapping

Course Code: 54FT721

Course Title: Entrepreneurship Development

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO 4
CO1: Importance, growth, characteristics and qualities of entrepreneur.	2	1	1	1	1	1	1	3	1	3	1	1	3	3	3	3
CO2: Basics of Entrepreneurships.	2	3	1	1	2	1	3	1	2	1	1	3	3	3	3	3
CO3: SWOT analysis and Women Entrepreneurship.	2	3	1	1	3	1	1	1	2	2	1	3	3	3	3	3
CO4: Policies of establishment of Food Micro scale industry.	2	3	1	1	3	1	3	1	2	3	1	3	3	3	3	3
CO5: Export import of Goods for Food Sector.	2	1	1	1	3	1	3	3	2	2	1	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs	CO	SOs No	Classroom Instruction(CI)	Self Learning(SL)
PO 1 to 12 and PSO 1 to 4	CO1: Importance, growth, characteristics and qualities of entrepreneur.	SOs 1-5	Unit-I Entrepreneurship: Importance and growth, characteristics and qualities of entrepreneur, role of entrepreneurship, ethics and social responsibilities; Entrepreneurship development: Assessing overall business environment in the Indian economy; Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs; Globalization and the emerging business/entrepreneurial environment.	Knowledge about various Organ Systems
PO 1 to 12 and PSO 1 to 4	CO2: Basics of Entrepreneurships.	SOs 1-5	**Unit-II** Concept of entrepreneurship, entrepreneurial and managerial characteristics, managing an enterprise, motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs	Knowledge about Ecology around native places
PO 1 to 12 and PSO 1 to 4	CO3: SWOT analysis and Women Entrepreneurship.	SOs 1-5	**Unit-III** SWOT analysis, generation, incubation and commercialization of ideas and innovations; Women entrepreneurship: Role and importance, problems; Corporate entrepreneurship: Role, mobility of entrepreneur.	Knowledge about types of Frog
PO 1 to 12 and PSO 1 to 4	CO4: Policies of establishment of Food Micro scale industry.	SOs 1-5	**Unit-IV** Entrepreneurial motivation; Planning and evaluation of projects: Growth of firm, project identification and selection, factors inducing growth; Project feasibility study: Post planning of project, project planning and control; New venture management; Creativity. Government schemes and incentives for promotion of entrepreneurship; Government policy on small and medium enterprises (SMEs)/SSIs	Organ system of Frog with Human
PO 1 to 12 and PSO 1 to 4	CO5: Export import of Goods for Food Sector.	SOs 1-5	**Unit-V** Export and import policies relevant to food processing sector; Venture capital; Contract farming and joint ventures, public-private partnerships; Overview of food industry inputs; Characteristics of Indian food processing industries and export; Social responsibility of business	Knowledge about Microbes and Cell system

Semester-VII

Course Code: 54FT771

Course Title : Skill Development (Fruits and Vegetable Processing)- Lab

Pre- requisite: Students should have basic knowledge of fruits and vegetable products including with different types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing of various fruits and vegetable products. They have to develop employability skills, intellectual skills, core of key skills and personal attributes with full responsibility and self-confidence.

Rationale: The students studying Food Technology should possess foundational understanding about fruits and vegetable products including with their processing, packaging and storage conditions.

Course Outcomes:

54FT771.1: Ability to develop employability skills in the field of fruits and vegetable processing.

54FT771.2: Ability to enhance technical knowledge and skills in the field of fruits and vegetable processing.

54FT771.3: Ability to assess the quality of fruits and vegetable processing products.

54FT771.4: Ability to recall the standards and regulations of fruits and vegetable processing industries.

54FT771.5: Ability to demonstrate skills in fruits and vegetable processing industries.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT771	Skill Development (Fruits and Vegetable Processing)- Lab	0	8	0	0	0	4

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning, **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment (Practical):

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		End Semester Practical Exam (ESPE) (Viva-Voce+Record)
			Viva-Voce	Record	
PCFT	54FT771	Skill Development (Fruits and Vegetable Processing)- Lab	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment

The end of semester assessment, the student will be required to prepare a detailed Project Report on Skill Development (Fruits and Vegetable Processing). The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Making Project Report and Power Point Presentation on the same skill.
2. Take guidance of concerned teacher that assigned for the same subject.

Curriculum Development Team

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Cos, POs and PSOs Mapping

Course Title: B.Tech. (Food Technology)

Course Code: 54FT771

Course Title: Skill Development (Fruits and Vegetable Processing)- Lab

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability:	Ethics	Individual and team work:	Communication:	Project management and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacture.	Ability to understand the day to plant operational problems of food manufacture	Ability to understand the latest food manufacturing technology.	Ability to use the research based innovative knowledge for SDGs
CO-1 Ability to develop employability skills in the field of fruits and vegetable processing.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO-2 Ability to enhance technical knowledge and skills in the field of fruits and vegetable processing.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO- 3 Ability to assess the quality of fruits and vegetable processing products.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3

CO- 4 Ability to recall the standards and regulations of fruits and vegetable processing industries.	3	2	2	2	3	3	3	2	3	3	2	3	3	3	3	3
CO- 5 Ability to demonstrate skills in fruits and vegetable processing industries.	3	2	2	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: Ability to develop employability skills in the field of fruits and vegetable processing.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	-	-	-
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Ability to enhance technical knowledge and skills in the field of fruits and vegetable processing.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	-	-	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3: Ability to assess the quality of fruits and vegetable processing products.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Ability to recall the standards and regulations of fruits and vegetable processing industries.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Ability to demonstrate skills in fruits and vegetable processing industries.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	-	-	

AKS University

Faculty of Agriculture Science and Technology

Department of Food Technology

Curriculum of B.Tech. (Food Technology) Program

(Revised as on 01 August 2023)

Semester-VII

Course Code:	54FT773
Course Title :	Seminar
Pre- requisite:	Students will be required to prepare and deliver a Seminar as well as submit a written report on the topic related to core of key skills assigned to him/her with full responsibility and self-confidence.
Rationale:	The students studying Food Technology should possess Seminar for enhancing their basic technical knowledge and basic skills of the core field.

Course Outcomes:

54FT773.1: Relate different components of food technology, skills and scientific techniques followed in various food business/industry.

54FT773.2: Understand hands on expertise in their relevant fields.

54FT773.3: Analyze the skills and knowledge required for a particular job function.

54FT773.4: Get exposure to advanced manufacturing and analytical tools to evaluate complex engineering problem.

54FT773.5: Bridge the gap between academia and ever-changing demand driven industrial business scenario to develop the need of industry with the polarization paradigm.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	S W	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT773	Seminar	0	0	0	0	0	5

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment (Practical):

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		End Semester Practical Exam (ESPE) (Viva-Voce+Record)
			Viva-Voce	Record	
PCFT	54FT773	Seminar	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment

The end of semester assessment, the student will be required to prepare and deliver a seminar as well as submit a written report on the topic assigned to him/her. The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Making Report and Power Point Presentation on the same topic of Seminar.
2. Take guidance of concerned teacher that assigned for the same subject.

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Cos. POs and PSOs Mapping

Course Title: B.Tech. (Food Technology)

Course Code: 54FT773

Course Title: Seminar

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engine ering knowle dge	Prob lem anal ysis	Desig n/dev elop ment of soluti ons	Cond uct invest igatio ns of compl ex probl ems	Mode rn tool usage	The engi neer and soci ety	Environ ment and sustain ability:	Ethics	Indivi dual and team work:	Com munic ation:	Project manage ment and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacture.	Ability to understand the day to plant operational problems of food manufacture	Ability to understand the latest food manufacturin g technology.	Ability to use the research based innovative knowledge for SDGs
CO 1 Relate different components of food technology, skills and scientific techniques followed in various food business/industry.	3	2	1	3	2	3	3	2	3	3	3	3	3	3	3	3
CO 2 Understand hands on expertise in their relevant fields.	3	2	1	3	3	3	3	2	3	3	3	3	3	3	3	3
CO 3 Analyze the skills and	3	2	1	3	3	3	3	2	3	3	3	3	3	3	3	3

knowledge required for a particular job function.																
CO 4 Get exposure to advanced manufacturing and analytical tools to evaluate complex engineering problem.	**3**	**2**	**1**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO -5 Bridge the gap between academia and ever-changing demand driven industrial business scenario to develop the need of industry with the polarization paradigm.	**3**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 1: Relate different components of food technology, skills and scientific techniques followed in various food business/industry.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	-	-	-
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 2: Understand hands on expertise in their relevant fields.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 3: Analyze the skills and knowledge required for a particular job function.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 4: Get exposure to advanced manufacturing and analytical tools to evaluate complex engineering problem.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 5: Bridge the gap between academia and ever-changing demand driven industrial business scenario to develop the need of industry with the polarization paradigm.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	-	-	

Semester-VII

Course Code: 54FT772

Course Title : Industrial Training-II

Pre- requisite: Students should have their technical knowledge and basic skills of the core field specially from quality and production department of the concerned food industry. They have to develop employability skills, intellectual skills, core of key skills and personal attributes along with increase knowledge about how organization work with full responsibility and self-confidence.

Rationale: The students studying Food Technology should possess Industrial Training for enhancing their basic technical knowledge and basic skills of the core field especially from quality and production department of the concerned food industry including with gain experiences about various laboratory and managerial skills in the working environment in the same organization. They have to work on their employability, intellectual skills and core of key skills.

Course Outcomes:

54FT772.1: To expose the students to actual working environment and enhance their knowledge and technical skills.

54FT772.2: To instill the good qualities of integrity, responsibility and self-confidence.

54FT772.3: To enhance technical knowledge from quality and production department.

54FT772.4: To develop employability skills, intellectual skills, core of key skills and personal attributes.

54FT772.5: To develop knowledge about how organizations work.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT772	Industrial Training-II	0	10	0	0	0	5

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment (Practical):

Course category	**Course Code**	**Course Title**	**Scheme of Assessment (Marks)**		
			Practical Assessment		**End Semester Practical Exam (ESPE) (Viva-Voce+Record)**
			Viva-Voce	**Record**	
PCFT	54FT772	Industrial Training-II	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment

The end of semester assessment for Industrial Training-II will be of 01 month duration carried out during the semester break after VIth Semester. The students will submit their reports and make a presentation in the VIIth Semester. The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment

Suggested Instructional/Implementation Strategies:

1. Visit to food plant for completion of Industrial Training-II.
2. Making Report and Power Point Presentation after finishing Industrial Training-II.
3. Take guidance of Plant Manager along with free to discussion to concerned department.

Curriculum Development Team

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Cos, POs and PSOs Mapping

Course Title: B.Tech. (Food Technology)

Course Code: 54FT772

Course Title: Industrial Training-II

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engine ering knowle dge	Prob lem anal ysis	Desig n/dev elop ment of soluti ons	Cond uct invest igatio ns of compl ex probl ems	Mode rn tool usage	The engi neer and soci ety	Environ ment and sustain ability:	Ethics	Indivi dual and team work:	Com munic ation:	Project manage ment and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacture.	Ability to understand the day to plant operational problems of food manufacture	Ability to understand the latest food manufacturin g technology.	Ability to use the research based innovative knowledge for SDGs
CO 1 To expose the students to actual working environment and enhance their knowledge and technical skills	3	3	3	1	2	3	3	2	3	3	2	3	3	3	3	3
CO 2 :To instill the good qualities of integrity, responsibility and self-confidence.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3
CO 3 : To enhance technical knowledge from quality and production department.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3
CO 4 : To develop employability skills, intellectual skills, core of key skills and personal attributes.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3
CO 5 : To develop knowledge about how organizations work.	3	3	3	2	3	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: To expose the students to actual working environment and enhance their knowledge and technical skills.	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5**			
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: To instill the good qualities of integrity, responsibility and self-confidence.	**SO2.1 SO2.2 SO2.3 SO2.4 SO2.5**			
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3:To enhance technical knowledge from quality and production department.	**SO3.1 SO3.2 SO3.3 SO3.4 SO3.5**			
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: To develop employability skills, intellectual skills, core of key skills and personal attributes.	**SO4.1 SO4.2 SO4.3 SO4.4 SO4.5**			
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: To develop knowledge about how organizations work.	**SO5.1 SO5.2 SO5.3 SO5.4 SO5.5**			

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2. Er. Rajesh kumar mishra, Assistant Professor , Department of Agriculture Engineering and Food Technology
3. Er. Gyan Prakash, Assistant Professor, Department of Food Technology
4. Er. Devendra pandey, Assistant Professor, Department of Food Technology
5. Er. Vikas Kumar, Assistant professor, Department of Food Technology

6. Mr. Virendra kumar pandey, Assistant Professor, Department of Food Technology

Semester-VIII

Semester-VIII

Course Code: **54FT871**

Course Title : **Research Project**

Pre- requisite: Students will be required to prepare a detailed Research Project Report on fabrication of an equipment / establishment of a plant for processing of a food commodity for production of food products with complete layout and economic analysis for assessment with full responsibility and self-confidence.

Rationale: The students studying Food Technology should possess Research Project for enhancing their basic technical knowledge and basic skills of the core field.

Course Outcomes:

54FT871.1:

Introduction: Understand general area of research and summarize along with performing work.

54FT871.2:

Review of the Literature:

Suggest some theoretical framework to be explained further in this chapter along with describes and analyzes previous research on the topic.

54FT871.3:

Materials and Methods: Describe and justifies the data gathering method.

54FT871.4:

Result and Discussion: Analyze data and discuss about findings in relation to the theoretical framework introduced in the review of literature.

54FT871.5:

Summary and Conclusions:

Discuss about significant progress of already collecting data including suggestions for further research.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	S W	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT871	**Research Project**	0	15	0	0	0	15

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning and **C:** Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment (Practical):

Course category	**Course Code**	**Course Title**	**Scheme of Assessment (Marks)**		
			Practical Assessment		**End Semester Practical Exam (ESPE) (Viva-Voce+Record)**
			Viva-Voce	Record	
PCFT	54FT871	Research Project	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment

The end of semester assessment, the student will be required to prepare a detailed Research Project Report on fabrication of an equipment / establishment of a plant for processing of a food commodity for production of food products with complete layout and economic analysis for assessment. The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Making Research Project Report and Power Point Presentation on the same Project Report.
2. Take guidance of concerned teacher that assigned for the same subject.

Curriculum Development Team

1. **Er.Devendra Pandey, Department of Food Technology, AKS University, Satna (M.P)**
2. **Er. Rajesh Kumar Mishra, Head I/C, Department of Food Technology, AKS University, Satna (M.P)**

Cos, POs and PSOs Mapping

Course Title: B.Tech. (Food Technology)
Course Code: 54FT871
Course Title: Research Project

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engine ering knowle dge	Prob lem anal ysis	Desig n/dev elop ment of soluti ons	Cond uct invest igatio ns of compl ex probl ems	Mode rn tool usage	The engi neer and soci ety	Environ ment and sustain ability:	Ethics	Indivi dual and team work:	Com munic ation:	Project manage ment and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacture.	Ability to understand the day to plant operational problems of food manufacture	Ability to understand the latest food manufacturin g technology.	Ability to use the research based innovative knowledge for SDGs
CO 1 : Introduction:	3	3	3	3	2	3	3	2	3	3	2	3	3	3	3	3
CO 2 : Review of the Literature:	3	3	3	3	2	3	3	2	3	3	2	3	3	3	3	3
CO 3 : Materials and Methods:	3	3	3	3	2	3	3	2	3	3	2	3	3	3	3	3
CO 4 : Result and Discussion:	3	3	3	3	2	3	3	2	3	3	2	3	3	3	3	3
CO 5 : Summary and Conclusions:	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 1: Introduction: Understand general area of research and summarize along with performing work.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	-	-	-
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 2: Review of the Literature: Suggest some theoretical framework to explained further in this chapter along with describes and analyzes previous research on the topic.	**SO2.1** **SO2.2** **SO2.3** **SO2.4** **SO2.5**	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 3: Materials and Methods:Describe and justifies the data gathering method.	**SO3.1** **SO3.2** **SO3.3** **SO3.4** **SO3.5**	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 4: Result and Discussion: Analyze data and discuss about findings in relation to the theoretical framework introduced in the review of literature.	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5**	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO 1,2, 3, 4, 5**	CO 5: Summary and Conclusions: Discuss about significant progress of already collecting data including suggestions for further research.	**SO5.1** **SO5.2** **SO5.3** **SO5.4** **SO5.5**	-	-	

Semester-VIII

Course Code: 54FT872

Course Title : Industrial Training-III

Pre- requisite: Students should have their technical knowledge and basic skills of the core field specially from quality and production department of the concerned food industry. They have to develop employability skills, intellectual skills, core of key skills and personal attributes along with increase knowledge about how organization work with full responsibility and self-confidence.

Rationale: The students studying Food Technology should possess Industrial Training for enhancing their basic technical knowledge and basic skills of the core field especially from quality and production department of the concerned food industry including with gain experiences about various laboratory and managerial skills in the working environment in the same organization. They have to work on their employability, intellectual skills and core of key skills.

Course Outcomes:

54FT872.1: To expose the students to actual working environment and enhance their knowledge and technical skills.

54FT872.2: To instill the good qualities of integrity, responsibility and self-confidence.

54FT872.3: To enhance technical knowledge from quality and production department.

54FT872.4: To develop employability skills, intellectual skills, core of key skills and personal attributes.

54FT872.5: To develop knowledge about how organizations work.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	S W	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCFT)	54FT872	Industrial Training-III	0	14	0	0	0	7

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment (Practical):

Course category	Course Code	Course Title	Scheme of Assessment (Marks)		
			Practical Assessment		**End Semester Practical Exam (ESPE) (Viva-Voce+Record)**
			Viva-Voce	Record	
PCFT	54FT872	Industrial Training-III	60	40	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Suggestion for End Semester Assessment

The end of semester assessment for Industrial Training-III will be of 01 month duration carried out during the semester break after VIIth Semester. The students will submit their reports and make a presentation in the VIIIth Semester. The internal assessment will be carried out by the internal faculties.

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Visit to food plant for completion of Industrial Training-III.
2. Making Report and Power Point Presentation after finishing Industrial Training-III.
3. Take guidance of Plant Manager along with free to discussion to concerned department.

Curriculum Development Team

1. **Dr. Pukhraj Meena, Assistant Professor, Department of Food Technology, AKS University, Satna (M.P)**
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Cos, POs and PSOs Mapping

Course Title: B.Tech. (Food Technology)

Course Code: 54FT872

Course Title: Industrial Training-III

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engine ering knowle dge	Prob lem anal ysis	Desig n/dev elop ment of soluti ons	Cond uct invest igatio ns of compl ex probl ems	Mode rn tool usage	The engi neer and soci ety	Environ ment and sustain ability:	Ethics	Indivi dual and team work:	Com munic ation:	Project manage ment and finance:	Life-long learning	The ability to apply technical & engineering knowledge for production and quality of food manufacture.	Ability to understand the day to plant operational problems of food manufacture	Ability to understand the latest food manufacturin g technology.	Ability to use the research based innovative knowledge for SDGs
CO 1 To expose the students to actual working environment and enhance their knowledge and technical skills.	3	3	3	1	2	3	3	2	3	3	2	3	3	3	3	3
CO 2 To instill the good qualities of integrity, responsibility and self-confidence.	3	3	3	2	3	3	3	2	3	3	2	3	3	3	3	3

CO 3 To enhance technical knowledge from quality and production department.	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO 4 To develop employability skills, intellectual skills, core of key skills and personal attributes.	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO 5 To develop knowledge about how organizations work.	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 1: To expose the students to actual working environment and enhance their knowledge and technical skills.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: To instill the good qualities of integrity, responsibility and self-confidence.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	-	-	-
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 3:To enhance technical knowledge from quality and production department.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: To develop employability skills, intellectual skills, core of key skills and personal attributes.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	-	-	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: To develop knowledge about how organizations work.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	-	-	

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