Curriculum Book

Assessment and Evaluation Scheme

based on

Outcome Based Education (OBE)

of

Bachelor of Technology
in
Agricultural Engineering

4 Year Degree Programme

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

AKS University
Satna, Madhya Pradesh, India

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

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Forwarding

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

The alignment of course outcomes (COs), Programme Outcome (POs) and Programme specific outcomes (PSOs) has been intricately executed, aligning perfectly with the requisites of NEP-2020 and NAAC standards. I hold the belief that this 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 Agricultural Engineering program for implementation in the upcoming session.

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

01 August 2023

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 outcome-based curriculum in collaboration with academia and industry experts. This curriculum design should be informed by the latest technological advancements, market demands, the guide lines 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 Agricultural 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 Agricultural engineering technology.

Agricultural engineering is at the heart of sustainable development and plays a critical role in addressing the global challenges of Agricultural mechanization, food security, environmental conservation, and rural development. Our work contributes directly to innovations that improve agricultural practices, enhance productivity, and make farming more efficient and sustainable.

As we move forward, the need for innovative solutions in agriculture is more pressing than ever. Your dedication to research, education, and practical applications is invaluable not only to our university but to the broader community and the world. The integration of cutting-edge technology, data analytics, and engineering principles in agriculture is transforming the way we approach challenges and providing new opportunities for growth.

This curriculum integrates hands-on training, industrial visits, on-the-job experiences, research, and development. This comprehensive approach ensures that students receive a well-rounded education, fostering their skills and preparing them for success in advancing the agricultural sector. I am confident that the updated curriculum for Agricultural Engineering will not only enhance students' technical abilities but also significantly improve their employability prospects.

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

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, shifts have taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Engineering education play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the AKS University, Satna (MP) to revise the existing curricula of B.Tech. degree programme as per the needs of the Agriculture, industries and making them compliant are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of B.Tech. degree programme. The curricula for Agricultural Engineering programme has been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of degree programme.

The real success of this programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the degree programme to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Dean
Faculty of Agri. Science and Technology

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agricultural Engineering and Food Technology

B.Tech. (Agricultural Engineering) Programme

About Department

This programme aims to prepare field/industry ready professionals who are prepared to provide engineering solutions to crop production problems in agriculture. The curriculum for this programme is designed in such a way that it allows for multiple experiential learning opportunities to students so that they can contribute to the development and application of automation in agriculture. The department has well equipped with state of the art laboratories for hands on training of the students. The curriculum includes topics such as trends in automation, optimisation techniques, operational models, fundamentals of farming mechanization, model formulation and system engineering and simulation and systems analysis of theoretical crop science. Programme has duly follows the ICAR Vth Dean's committee recommendations as well as student's READY programme.

Vision:

To become leading centre of learning that incorporates the academic excellence and innovative research to make significant contribution in the field of agricultural engineering.

Mission:

- Enable students to seek fulfilling careers in agri-based industries, agricultural research or as government employee and Entrepreneurs.
- Enable alumni to be respectable in society with responsible attitude and expertise in the agriculture area to help the sustainable livelihoods.
- Empower faculty to have impact on society for the contribution and achievement.
- Create teaching and learning models with a collaborative platform which could be emulated by other institutions.
- Be recognized in agriculture sector; improve farmers and agriculture allied sectors.

MAPPING OF CO/PO/PSO

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- **I.** To train and educate students with intellectual knowledge and skills in agricultural resources i.e. soil & water management, agricultural production handling & processing, farm machinery/power and farm management.
- **II.** To provide a sound theoretical knowledge in engineering principles applied to agriculture.
- **III.** To prepare students for a successful agricultural engineering career integrating all aspects of engineering in agriculture.
- **IV.** To develop innovative capacity of students for increasing agricultural production with scarce water resources available.
- **V.** To impart positive and responsive out their mission as engineers research attitudes, initiative and creative thinking in their mission as engineers.
- **VI.** To understand ethical issues and responsibility of serving the society and the environment atlarge.

PROGRAM OUTCOMES (POs)

Graduates of the programme B.Tech. Agricultural Engineering will be able to:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
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 relevantto the professional engineering practice.

7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
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.
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.
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)

Graduates of the programme B.Tech. Agricultural Engineering will be able to

1. To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.
2. To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.
3. To inculcate entrepreneurial skills through strong Industry-Institution linkage.
4. Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.

PEOs / POs MAPPING:

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	3	3	-	-	-	-	-	-	-	1	-	-
II	-	-	3	3	3	-	-	-	-	-	1	-
III	2	2	2	-	-	-	3	-	1	-	1	-
IV	-	-	-	-	-	3	3	-	-	2	1	-
V	-	-	2	-	-	3	-	3	3	-	-	3
VI	-	-	-	-	-	3	3	3	-	2	-	2

GENERAL COURSE STRUCTURE & THEME

1. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	0 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 Engineering has about 186 credits, the total number of credits proposed for the four-year B. Tech. in Agricultural Engineering is kept as 186 considering ICAR Vth Dean's Committee, NEP-20 and NAAC guidelines.

3. Structure of UG Program in Agricultural Engineering:

The structure of UG program in Agricultural Engineering 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)	17.98	34
2	Engineering Sciences (ESC)	20.63	39
3	Humanities and Social Sciences (HMSC)	03.18	6
4	Program Core (PCC)	29.10	55
5	Program Electives (PEC)	04.77	9
6	Open Electives (OEC)	0	0
7	Project(s) (PRC)/ In Plant Training (OPT)/ Seminar(PSC)	22.23	42
9	Indian Knowledge System	01.05	2
10	Sustainable Development Goal	01.05	2
Total		**100.00**	**189**

General Couse Structure and Credit Distribution

Curriculum of B.Tech. Agricultural Engineering

Semester-I					Semester-II				
Course Title	**Credit**				**Course Title**	**Credit**			
	L	**P**	**T**			**L**	**P**	**T**	
Engineering Mathematics-I	3	0	1	3	Engineering Mathematics-II	3	0	1	3
Engineering Physics	2	1	1	3	Environmental Science and Disaster Management	2	1	0	3
Engineering Chemistry	2	1	0	3	Entrepreneurship Development and Business Management	3	0	0	3
Thermodynamics, Refrigeration & Air condition	2	1	1	3	Fluid Mechanics & Open Channel Hydraulics	2	1	1	3
Surveying and Leveling	2	1	0	3	Theory of Machine	2	0	1	2
Engineering Drawing	0	2	0	2	Workshop Technology and Practices	1	2	1	3
Principle of Soil Science	2	1	0	3	Strength of Materials	1	1	1	2
Engineering Mechanics	2	1	1	3	Web Designing and Internet Applications	1	1	1	2
Total Credit	**15**	**8**	**4**	**23**	**Total Credit**	**15**	**6**	**6**	**21**
	23					**21**			
Semester-III					**Semester-IV**				
Course Title	**Credit**				**Course Title**	**Credit**			
	L	**P**	**T**			**L**	**P**	**T**	
Principles of Horticultural Crops & Plant Protection	1	1	1	2	Building Construction & Cost Estimation	2	0	1	2
Principles of Agronomy	2	1	0	3	Auto CAD Applications	0	2	1	2
Communication Skills and Personality Development	1	1	1	2	Applied Electronics & Instrumentation	2	1	0	3
Engineering Mathematics-III	3	0	1	3	Tractor and Automotive Engines	2	1	0	3
Soil Mechanics	1	1	1	2	Engineering Properties of Agricultural Produce	1	1	1	2
Theory of Structures	1	1	1	2	Watershed Hydrology	1	1	1	2
Machine Design	2	0	1	2	Irrigation Engineering	2	1	0	3
Heat & Mass Transfer	2	0	1	2	Sprinkler & Micro Irrigation Systems	1	1	1	2
Electrical Machines and Power Utilization	2	1	0	3	Fundamentals of Renewable Energy Sources	2	1	0	3
Total Credit	**15**	**6**	**7**	**21**	**Total Credit**	**13**	**9**	**5**	22
	21					**22**			

Semester-V					Semester-VI				
Course Title	Credit				Course Title	Credit			
	L	P	T			L	P	T	
Tractor Systems and Controls	2	1	0	3	Computer Programming and Data Structures	1	2	1	3
Farm Machinery and Equipment-I	2	1	0	3	Farm Machinery and Equipment-II	2	1	0	3
Agricultural Structures and Environmental Control	2	1	0	3	Post Harvest Engineering of Horticultural Crops	1	1	0	2
Post Harvest Engineering of Cereals, Pulses and Oil Seeds	2	1	0	3	Water Harvesting & Soil Conservation Structures	2	1	0	3
Soil and Water Conservation Engineering	2	1	0	3	Groundwater, Wells and Pumps	2	1	0	3
Watershed Planning and Management	1	1	1	2	Tractor and Farm Machinery Operation and Maintenance	0	2	1	2
Drainage Engineering	1	1	1	2	Dairy and Food Engineering	2	1	0	3
Renewable Power Sources	2	1	0	3	Bio-energy Systems: Design and Applications	2	1	0	3
In-plant training-I (Student READY)	0	5	0	5		**12**	**10**	**2**	**22**
	14	**13**	**2**	**27**		**15**	**6**	**6**	**22**
Total Credit	**27**				**Total Credit**	**21**			
Semester-VII					**Semester-VIII**				
Course Title	**Credit**				**Course Title**	**Credit**			
	L	**P**	**T**			**L**	**P**	**T**	
10- weeks Industrial Attachment/Internship (Student READY)	0	10	0	10	Elective course	2	1	0	3
10- weeks Experiential Learning On campus (Student READY)	0	10	0	10	Elective course	2	1	0	3
In-plant training-II (Student READY)	0	5	0	5	Elective course	2	1	0	3
Educational Tour (Student READY)	0	2	0	2	Project Planning and Report Writing (Student READY)	0	10	0	10
	0	**27**	**0**	**27**		**06**	**13**	**0**	**19**
Total Credit	**27**				**Total Credit**	**19**			

i. **Humanities & Social Sciences & Mgt. Electives (HSM):** Any 2 courses from the list of those offered.

ii. **Open Electives (OEL)**: Any 3 courses (from any department), based on individual interest and project.

iii. **Industry internship**: Internship in industry, start-up or R&D lab in 2nd/3rd year summer is compulsory (audit). Longer internship for 10- weeks (10 credits) can be taken in VIIth semester, in lieu of Engineering Project. The internship must be properly evaluated.

Course code and definition:

L	=	Lecture
T	=	Tutorial
P	=	Practical Credit
BSC	=	BasicScience 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. e.g.

101, 102… etc. for first semeter	201, 202… etc. for second semeter
301, 302… etc. for third semeter	401, 402… etc. for forth semeter
501, 502… etc. for fifth semeter	601, 602… etc. for sixth semeter
701, 702… etc. for seventh semeter	801, 802… etc. for eighth semeter

Department of Agril. Engineeering & Food Technology

Curriculum of B.Tech. (Agril. Engineeing) Program

(Revisedason 01 August 2023)

Category-wiseCourses

HUMANITIES & SOCIAL SCIENCES COURSES & MANAGEMENT COURSES [HSMC] (TOTAL 02)

Sl.	Code No.	Subject	Semester	Credits
1	22MT223	Entrepreneurship Development and Business Management	2	3
2	22SD324	Communication Skills and Personality Development	3	3
TotalCredits:				**06**

BASIC SCIENCE COURSE [BSC] (TOTAL 11)

Sl.	CodeNo.	Subject	Semester	Credits
1	22SC126	Principle of Soil Science	1	3
2	22PH122	Engineering Physics	1	3
3	22MS121	Engineering Mathematics - I	1	3
4	22CH123	Engineering Chemistry	1	3
5	22MS221	Engineering Mathematics - II	2	3
6	22EV222	Environmental Sciences & Disaster Management	2	3
7	22CA228	Web Designing and Internet Applications	2	2
8	22MS321	Engineering Mathematics-III	3	3
9	22HO322	Principles of Horticultural Crops & Plant Protection	3	2
10	22AN323	Principles of Agronomy	3	3
11	22EE428	Fundamentals of Renewable Energy Sources	4	3
12	22CA621	Computer Programming & Data Structure	6	3
TotalCredits:				**34**

ENGINEERING SCIENCE COURSE [ESC] (TOTAL 16)

Sl.	CodeNo.	Subject	Semester	Credits
1	22ME175	Engineering Drawing - Lab	1	2
2	22ME127	Engineering Mechanics	1	3
3	22ME124	Thermodynamics Refrigeration & Air Condition	1	3

4	22CE125	Surveying & Levelling	1	3
5	22ME227	Strength of Materials	2	2
6	22ME226	Workshop Technology and Practices	2	3
7	22ME225	Theory of Machine	2	2
8	22CE224	Fluid Mechanics & Open Channel Hydraulics	2	3
9	22ME328	Heat and Mass Transfer	3	2
10	22ME327	Machine Design	3	2
11	22EE329	Electrical Machines and Power Utilization	3	3
12	22CE326	Theory of Structures	3	2
13	22CE325	Soil Mechanics	3	2
14	22ME471	Auto Cad Applications - Lab	4	2
15	22EE422	Applied Electronics & Instrumentation	4	3
16	22CE421	Building Construction & Cost Estimation	4	2
TotalCredits:				**39**

PROFESSIONAL CORE COURSES [PCC] (Total20)

Sl.	CodeNo.	Subject	Semester	Credits
1	22AE427	Sprinkler & Micro Irrigation Systems	4	2
2	22AE426	Irrigation Engineering	4	3
3	22AE425	Watershed Hydrology	4	2
4	22AE424	Engineering Properties of Agricultural Produce	4	2
5	22AE423	Tractor and Automotive Engines	4	3
6	22HO524	Post Harvest Engineering of Cereals, Pulses and Oil Seeds	5	3
7	22AE528	Renewable Power Sources	5	3
8	22AE527	Drainage Engineering	5	2
9	22AE526	Watershed Planning and Management	5	3
10	22AE525	Soil and Water Conservation Engineering	5	3
11	22AE523	Agricultural Structures and Environmental Control	5	3
12	22AE522	Farm Machinery and Equipment - I	5	3
13	22AE521	Tractor Systems and Controls	5	3
14	22AE678	Tractor and Farm Machinery Operation and Maintenance - Lab	6	2
15	22AE627	Bio-Energy Systems Design and Applications	6	3
16	22AE626	Dairy and Food Engineering	6	3
17	22AE625	Groundwater, Wells and Pumps	6	3
18	22AE624	Water Harvesting & Soil Conservation Structures	6	3
19	22AE623	Post Harvest Engineering of Horticultural Crops	6	2
20	22AE622	Farm Machinery and Equipment-II	6	3
Total Credits:				**54**

PROFESSIONAL ELECTIVE [PEC]

Total 3 cources (9 Credit) to be taken from the group on Project topic and individual interest basis

Sl.	CodeNo.	Subject	Semester	Credits
1	22AE823-A	Food Plant Design and Management	8	3
2	22AE823-B	Food Packaging Technology	8	3
3	22AE823-C	Development of Processed Food	8	3
4	22AE821-A	Landscape Irrigation Design And Management	8	3
5	29AE821-B	Remote Sensing & Gis Applications	8	3
6	29AE821-C	Minor Irrigation and Commond Area Development	8	3
7	22AE822-A	Mechenics of Tillage & Traction	8	3
8	22AE822-B	Tractor Design And Testing	8	3
9	22AE822-C	Precision Agriculture and System Management	8	3
TotalCredit				**9**

Project/ Dessertation (PRC)/ In Plant Training / Internship (IPT)/

Sl.	Code No.	Subject	Semester	Credits
1	22AE570	In-Plant Training - I	5	5
2	22AE773	Skill Development Training-II	7	5
3	22AE772	Experiential Learning on Campus	7	10
4	22AE771	Industrial Attachment/ Internship	7	10
5	22AE774	Educational Tour	7	2
6	22AE871	Project Planning and Report Writing (Student Ready)	7	10
Total Credit				**42**

OTHERCOURSES

Sl.	CodeNo.	Subject	Semester	Credits
1	SDGs 01	Sustainable Development Goals	2	2
2	IKS01	Indian Knowledge System	1	2
Total Credit				**04**

Distribution of Courses
For
B. Tech. (Agricultural Engineering)

First Year

S. No	Course No.	Subject	Credit Scheme			
			Total	**Theory**	**Practical**	**Tutorial***
		Ist Semester				
1	22MS121	Engineering Mathematics-I	3	3	0	1
2	22PH122	Engineering Physics	3	2	1	1
3	22CH123	Engineering Chemistry	3	2	1	0
4	22ME124	Thermodynamics Refrigeration & Air condition	3	2	1	1
5	22CE125	Surveying and Leveling	3	2	1	0
6	22ME175	Engineering Drawing	2	0	2	0
7	22SC126	Principle of Soil Science	3	2	1	0
8	22ME127	Engineering Mechanics	3	2	1	1
9	SDGs 01	Sustainable Development Goals	2	2	0	0
			25	**17**	**8**	**4**
		IInd Semester				
1	22MS221	Engineering Mathematics-II	3	3	0	1
2	22EV222	Environmental Science and Disaster Management	3	2	1	0
3	22MT223	Entrepreneurship Development and Business Management	3	3	0	0
4	22CE224	Fluid Mechanics & Open Channel Hydraulics	3	2	1	1
5	22ME225	Theory of Machine	2	2	0	1
6	22ME226	Workshop Technology and Practices	3	1	2	1
7	22ME227	Strength of Materials	2	1	1	1
8	22CA228	Web Designing and Internet Applications	2	1	1	1
9	IKS01	Indian Knowledge System	2	2	0	0
			23	**17**	**6**	**6**

*Tutorials hours will be considered as non credit

Distribution of Courses
For
B. Tech. (Agricultural Engineering)

Second Year

S. No	Course No.	Subject	Credit Scheme			
			Total	**Theory**	**Practical**	**Tutorial***
		IIIrd Semester				
1	22HO322	Principles of Horticultural Crops & Plant Protection	2	1	1	1
2	22AN323	Principles of Agronomy	3	2	1	0
3	22SD324	Communication Skills and Personality Development	2	1	1	1
4	22MS321	Engineering Mathematics-III	3	3	0	1
5	22CE325	Soil Mechanics	2	1	1	1
6	22CE326	Theory of Structures	2	1	1	1
7	22ME327	Machine Design	2	2	0	1
8	22ME328	Heat & Mass Transfer	2	2	0	1
9	22EE329	Electrical Machines and Power Utilization	3	2	1	0
			21	**15**	**6**	**7**
		IVth Semester				
1	22CE421	Building Construction & Cost Estimation	2	2	0	1
2	22ME471	Auto CAD Applications	2	0	2	1
3	22EE422	Applied Electronics & Instrumentation	3	2	1	0
4	22AE423	Tractor and Automotive Engines	3	2	1	0
5	22AE424	Engineering Properties of Agricultural Produce	2	1	1	1
6	22AE425	Watershed Hydrology	2	1	1	1
7	22AE426	Irrigation Engineering	3	2	1	0
8	22AE427	Sprinkler & Micro Irrigation Systems	2	1	1	1
9	22EE428	Fundamentals of Renewable Energy Sources	3	2	1	0
			22	**13**	**9**	**5**
***In-plant training-I Summer break June-July after IVth Semester (Student READY)**						

Tutorials hours will be considered as non credit

Distribution of Courses
For
B. Tech. (Agricultural Engineering)
Third Year

S. No	Course No.	Subject	Credit Scheme			
			Total	Theory	Practical	Tutorial*
		Vth Semester				
1	22AE521	Tractor Systems and Controls	3	2	1	0
2	22AE522	Farm Machinery and Equipment-I	3	2	1	0
3	22AE523	Agricultural Structures and Environmental Control	3	2	1	0
4	22HO524	Post Harvest Engineering of Cereals, Pulses and Oil Seeds	3	2	1	0
5	22AE525	Soil and Water Conservation Engineering	3	2	1	0
6	22AE526	Watershed Planning and Management	2	1	1	1
7	22AE527	Drainage Engineering	2	1	1	1
8	22AE528	Renewable Power Sources	3	2	1	0
9	22AE570	In-plant training-I (Student READY) Registration only	5	0	5	0
			27	**14**	**13**	**2**
		VIth Semester				
1	22CA621	Computer Programming and Data Structures	3	1	2	1
2	22AE622	Farm Machinery and Equipment-II	3	2	1	0
3	22AE623	Post Harvest Engineering of Horticultural Crops	2	1	1	0
4	22AE624	Water Harvesting & Soil Conservation Structures	3	2	1	0
5	22AE625	Groundwater, Wells and Pumps	3	2	1	0
6	22AE678	Tractor and Farm Machinery Operation and Maintenance	2	0	2	1
7	22AE626	Dairy and Food Engineering	3	2	1	0
8	22AE627	Bio-energy Systems: Design and Applications	3	2	1	0
			22	**12**	**10**	**2**
***In-plant training-II Summer break June-July after VIth Semester (Student READY)**						

*Tutorials hours will be considered as non credit

Distribution of Courses

For

B. Tech. (Agricultural Engineering)

Final (Forth) Year

S. No	Course No.	Title of the Course	Credit Scheme
VII Semester Student READY (Rural and Entrepreneurship Awareness Development Yojana)			
1.	22AE771	10- weeks Industrial Attachment/Internship (Student READY)	10(0+10)
2.	22AE772	10- weeks Experiential Learning On campus (Student READY)	10(0+10)
3.	22AE773	In-plant training-II (Student READY) Registration only	5(0+5)
4.	22AE774	Educational Tour (Registration only)	2 (0+2)
Total			**27(0+27)**
Educational tour during winter/January break			
VIII Semester Student READY (Rural and Entrepreneurship Awareness Development Yojana)			
1.	29AE8..	Elective course	3(2+1)
2.	29AE8..	Elective course	3(2+1)
3.	29AE8..	Elective course	3(2+1)
4.	22AE871	Project Planning and Report Writing (Student READY)	10(0+10)
Total			**19(6+13)**
Grand Total I to VIII semesters			**186 (85+97)**

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:

i. Physical activity
ii. Creative Arts
iii. Universal Human Values
iv. Literary
v. Proficiency Modules
vi. Lectures by Eminent People
vii. Visits to local Areas
viii. Familiarization to Dept./Branch & Innovations

Student READY (Rural and Entrepreneurship Awareness Development Yojana)

To reorient graduates of agriculture and allied subjects for ensuring and assuring employability and to develop entrepreneurs for emerging knowledge intensive agriculture, the component envisages the introduction of the program in the universities as an essential prerequisite for the award of degree to ensure hands on experience and practical training. Considering the variation in different streams of agricultural education and feasibility, the Department proposes to include the following five components, which are interactive and are conceptualized for building skills in project development and execution, decision-making, individual and team coordination, approach to problem solving, accounting, quality control, marketing and resolving conflicts, etc. with end to end approach in Student READY program.

i. Experiential Learning/Hands on Training
ii. Skill Development Training
iii. Rural Agriculture Work Experience
iv. In Plant Training/ Industrial attachment
v. Students Projects

The students will be required to have any three of the five components listed above depending on the requirement of their graduate education but it should be implemented for the complete year, so that their education upto level of III year may get right information in IV year and finally they should attend right stage of entrepreneurship.

Evaluation Scheme:

1. For Theory Courses:

i. The weightage of Internal assessment is 50% and
ii. End Semester Exam is 50%

The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

2. For Practical Courses:

i. The weightage of Internal assessment is 50% and
ii. End Semester Exam is 50%

The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme
Semester-I

Course Title: Engineering Mathematics –I

Course Code: **2**2MS121

Prerequisite: 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:

AE 101.1 Define and understand the concept of matrix, formulation. types of matrix and operation of matrix .Differentiate between different types of matrices

AE 101.2 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.

AE 101.3 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,

AE 101.14 Apply integration techniques, including substitution, integration by parts, and partial fractions. Application of double and triple integral and volume and surface of revolution.

AE 101.5 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.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CL	TL	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Basic Science Course (BSC)	**22MS121**	**Engineering Mathematics -I**	3	1	1	1	6	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

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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
BSC	**22MS121**	**Engineering Mathematics -I**	10	15	15	5	5	50	50	100
		Total								**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.

AE101.1 Define and understand the concept of matrix, formulation, types of matrix and operation of matrix differentiate between different types of matrices

Approximate Hours

Item	AppX. Hrs
CL	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand the concept of matrix andtypes. **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.	-	**Unit-1.0 Advanced Matrix Theory and Applications** 1.1.elementray matrix 1.2. elementary transformation 1.3. rank of matrix 1.4.reduction to normal form 1.5.G-J method 1.6 Tutorial-1 1.7. to find the inverse 1.8. eigen values 1.9 eigenvectors 1.10 normal form 1.11problem based on rank 1.12 Tutorial- 2	**SL.1** Define the matrix with types and operations. **SL.2** Apply Rank of matrix based on elementary transformation. **SL.3** Solve problems in rank elementary transformation, inverse of matrix, normal form.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze and problem based on matrix with basic operations.
ii. Apply elementary transformation to find rank of matrix and normal form.
iii. Discuss the application of cayley Hamilton theorem.

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

AE101.2 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.

Approximate Hours

Item	AppXHrs
CL	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**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	-	**Unit-2.0 Linear Transformations and Matrix Theory** 2.1.linear transformation 2.2. orthogonal 2.3.diagonolization 2.4-quadratic form 2.5. system of linear equations, 2.6.nature of rank 2.7.echelon form 2.8. cases on solution of system of linear equation 2.9. to find inverse by Cayley-Hamilton Theorem, 2.10. linear systems of equations and homogenous and non homogenous 2.11 rank on coefficient and augmented matrix 2.12 Tutorial-1	**SL.1** Explore more advanced topics, such as linear transformations, matrix norms, and applications **SL.2** Understandand solving matrix problems, such as Gaussian elimination and case of system of linear equations. **SL.3** Apply matrix operations and concepts to solve real-world problems in various fields, such as physics, computer science, engineering, and economics

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the application of Matrices in Real Life.
ii. Write the properties of Eigen values.

b. Mini Project:
Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):
Quiz, Class Test.

AE101.3 Define and compute partial derivatives of functions of several variables, Definetaylor and maclurine curvature homogenous function and eulers theorem, Apply the chain rule to compute derivatives of composite functions involving multiple variables

Approximate Hours

Item	AppXHrs
Cl	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**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 Advanced Calculus and Multivariable Analysis** 3.1. Taylor expansion 3.2. total derivative, 3.3. Euler's theorem on Homogeneous function. 3.4. Application of Euler's theorem deduction I 3.5. Application of Euler's theorem deduction II 3.6.curvature 3.7. maxima, minima 3.8 saddle points, 3.9. working method on exttemum 3.10. partial derivatives 3.11 Questions of partial differvatives 3.12 Tutorial-1	**SL.1** Apply Eulers theorem to solve homogenous functionproblems **SL.2** Apply the two variable method to determine extrema. **SL.3** Solve problems involving multiple variables partial derivatives.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the Application of Euler's theorem in real life.
ii. Explain the difference between differential and partial differential

b. Mini Project:

Oral presentation,

c. Other Activities (Specify):

Quiz, Class Test.

AE101.4 Apply integration techniques, including substitution, integration by parts, and partial fractions. Application of double and triple integral and volume and surface of revolution.

Approximate Hours

Item	AppXHrs
CL	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**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	-	**Unit-4.0 Multivariable Integration and Applications** 4.1.volumeof revolution 4.surface of revolution of curves 4.3.double integrals 4.4. triple integrals 4.5 Tutorial-1 4.6. change of order of integration 4.7. application of double integral 4.8.application of triple integral 4.9.find area in double integral 4.10.find volume in triple integral 4.11area and volume as limit is constant. 4.12 Tutorial-2	**SL.1** Analyze volume and surface of revolution **SL.2** Apply double integral and triple integral **SL.3** Analyze and interpret solutions in double and triple integral with applications

SW-2 Suggested Sessional Work (SW):

a. Assignments:

I. Explain integral with definite and indefinite form .
II. Discuss about double and triple integral with applications.

b. Other Activities (Specify):
Quiz, Class Test.

AE101.5 Understand the scalar and vector point function, gradient and their physical intreperation. Sketch direction fields to visualize the behavior of solutions, Apply first-order ODEs to model and analyze various phenomena.

Approximate Hours

Item	AppXHrs
CL	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	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 Vector Calculus and Integral Theorems** 5.1.differentiation of vectors, scalar point function 5.2. vector differential operator 5.3. gradient of a scalar point function 5.4 divergence and curl of a vector point function 5.5. their physical interepretation 5.6 identities involving del 5.7. second order differential operator 5.8 line surface and volume integrals 5.9. stokes theorem 5.10. divergence theorem 5.11greens theorem 5.12 Tutorial-1	**SL.1** Apply differentiation techniques in vectors **SL.2** Use the gradient in vector and scalar point function **SL.3** Apply tests divergence and curlin vector point function to understand the line surface and volume integral.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the short note of gradient, divergence and curl of a vector point function.
ii. Write about line, surface and volume of a vector point function with example.

b. Mini Project:
Power Point Presentation.

c. Other Activities (Specify):
Quiz, Class Test.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
AE101.1 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	12	1	1	14
AE101.2 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.	12	1	1	14
AE101.3 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.	12	1	1	14
AE101.4 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.	12	1	1	14
AE101.5 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.	12	1	1	14
Total Hours	60	5	5	70

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			07
CO-2	Matrices-II	03	07	04			14
CO-3	Differential Calculus	02	06	02			10
CO-4	Integral Calculus.	03	03	02			11
CO-5	Vector calculus	03	02	02			08
Total		13	22	15			50

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

The end of semester assessment for Introduction to Portland cement 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
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6 .Seminar
7. Workshop

Suggested Learning Resources:

a) 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	36th Edition, 2010
3	Engineering Mathematics-I	D.C.Agrawal	Shree Sai Prakashan	10th Edition 2018
4	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw Hill	11th Reprint, 2010.

Curriculum Development Team:

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering
Course Code: 22MS121
Course Title: Engineering Mathematics –I

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE 101.1 Define and understand the concept of matrix, formulation. types of matrix and operation of matrix .Differentiate between different types of matrices	2	2	2	2	2	2	3	1	1	1	1	1	2	3	3	2
AE 101.2 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.	3	2	2	3	3	2	2	1	2	1	1	1	2	3	2	2
AE 101.3 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,	3	3	2	2	2	2	2	1	1	2	1	1	1	2	3	2
AE 101.14 Apply integration techniques, including substitution, integration by parts, and partial fractions. Application of double and triple integral and volume and surface of revolution.	3	3	2	3	2	2	2	1	2	2	1	1	3	3	3	2
AE 101.5 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.	3	3	2	3	2	2	2	1	1	1	1	1		3	2	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	**AE 101.1** Define and understand the concept of matrix, formulation. types of matrix and operation of matrix .Differentiate between different types of matrices	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Advanced Matrix Theory and Applications** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11, 1.12	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 101.2** 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.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 **Linear Transformations and Matrix Theory** 2.1, 2.2, 2.3, 2.4, 2.5,2.6,2.7,2.8,2.9,2.10,2.11,2.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 101.3** 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,	SO3.1 SO3.2 SO3.3		Unit-3 : **Advanced Calculus and Multivariable Analysis** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE101.14**Apply integration techniques, including substitution, integration by parts, and partial fractions. Application of double and triple integral and volume and surface of revolution.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 : **Multivariable Integration and Applications** 4.1, 4.2, 4.3, 4.4, 4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 101.5** 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.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit-5 : **Vector Calculus and Integral Theorems** 5.1, 5.2, 5.3, 5.4, 5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-I

Course Code:	22PH122
Course Title:	Engineering Physics
Pre-requisite:	A thorough understanding of basic concepts of Physics including magnetic materials, quantum mechanics, types of solids materials, behavior of light and basics of optical fiber.
Rationale:	This course gives an insight of applying different types of solids and their broad Classification and their properties as well as understanding the phenomenon of total internal reflection (TIR) and basic concept of illumination. It also helps the students to acquire basic knowledge of illumination.

Course Outcomes:

AE102 .1. T o explainthehow magnetic domain effect and contribute to the overall magnetic behavior of a material. Understanding of the principles governing the behavior of magnetic materials, and they should be able to apply, analyze and solve problems related to magnetism in various contexts.

AE102.2. To understands and solve the Schrödinger equation for a free particle. A comprehensive understanding of the behavior of particles in one and three dimensions enabling them to analyze and solve problems in a wide range of quantum systems.

AE102.3. Understand the electronic band structures for different solid materials and phenomenon of superconductivity and effect of temperature on superconductors.

AE102.4. Understanding the in-depth concepts pertaining to the various mechanisms involved for exhibiting laser light and detailed explanation of the formation of different types of Maser and Laser. Understanding of Holographic technique to produce 3D image of an object.

AE102.5. Understanding of structure and light propagation mechanism in an optical fiber and understanding the concept of illumination and laws of illumination and its related terms.

Scheme of Studies:

Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
		CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
22PH122	Engineering Physics	2	1	0	0	3	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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
BSC	**22AE423**	**Engineering Physics (Theory)**	0	15	15	0	0	30	50	80
		Engineering Physics (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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).

AE102.1: To explain the how magnetic domain effect and contribute to the overall magnetic behavior of a material. Understanding of the principles governing the behavior of magnetic materials, and they should be able to apply, analyze and solve problems related to magnetism in various contexts.

Approximate Hours

Item	Approx. Hrs
CL	5
LI	0
SW	2
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Acomprehensive understanding of the Classification of magnetic materials and their corresponding properties. **SO1.2**This law describes the magnetic susceptibility of a material in the paramagnetic state at temperatures near and above its Curie temperature **SO1.3** Adiabatic demagnetization is a process used in cryogenics to achieve extremely low temperatures. And how it is related to the temperature change in the material **SO1.4** Weiss molecular field theory as a mean-field approximation used to describe the interactions between magnetic moments in a ferromagnetic material. Weiss molecular field, a hypothetical internal magnetic field that accounts for the mutual interactions between atomic magnetic moments. **SO1.5**Langevin theory of dia and paramagnetic		**Unit-1Magnetism** 1.1 Classification of dia, Para and Ferro magnetic materials 1.2Curie-Weiss law 1.3 Adiabatic demagnetization 1.4 Weiss molecular field theory and ferromagnetism 1.5Langevin theory of dia and paramagnetic	Understanding of magnetic materials and how magnetic moment effects.

SW-1SuggestedSessionalWork (SW):

a. Assignments:

1. Broad Classification of magnetic materials and magnetic properties.
2. Curie Weiss law.

AE102.2. To understands and solve the Schrödinger equation for a free particle. A comprehensive understanding of the behavior of particles in one and three dimensions enabling them to analyze and solve problems in a wide range of quantum systems.

Approximate Hours

Item	AppXHrs
Cl	06
LI	0
SW	1
SL	1
Total	08

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learnin g (SL)**
SO2.1 How the wave-particle duality introduces the concept of quantum uncertainty, where the simultaneous measurement of certain pairs of properties (e.g. position and momentum) is constrained by the Heisenberg Uncertainty Principle. **SO2.3** U nderstanding of the time-dependent and time-independent Schrödinger equations, their significance in quantum mechanics, and their applications in describing the behavior of quantum systems. **SO2.3** The Zeeman effect describes the splitting of spectral lines in the presence of a magnetic field. This effect provides valuable information about the magnetic properties of atoms and is often used to study the behavior of electrons in magnetic fields. **SO2.4**The Stark effect and Paschen-Back effects describe the splitting of spectral lines in the presence of an electric field that interacts with the electric dipole moment associated with an atom or molecule.Paschen-Back effect as a modification of the Stark effect when the external magnetic field is strong. **SO2.5** Understanding the Raman spectroscopy as a vibrational spectroscopic technique involving the inelastic scattering of photons by molecular vibrations	.	**Unit-2 Quantum Physics** 2.1 Wave particle quality, de-Broglie concept 2.2 Uncertainty principle, Wave function 2.3Time dependent and time independent Schrodinger wave equations 2.4Qualitative explanation of Zeeman effect 2.5 Qualitative explanation of Stark effect and Paschan Back effect 2.6Raman spectroscopy	A comprehensive understanding concept of quantum mechanics and various phenomena involved in it.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

1. De-Broglie concept of matter waves.

AE102. 3: Understand the electronic band structures for different solid materials and phenomenon of superconductivity and effect of temperature on superconductors.

Approximate Hours

Item	AppXHrs
Cl	08
LI	14
SW	2
SL	1
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1F ormation of electronic bands in solids, and the implications of electronic band structures on the properties and behavior of materials. Interpret and analyze the electronic properties of different types of solids. Effective mass differs from the actual mass of an electron **SO3.2**Concept of the valence band, conduction band, and band gap in the context of metals, insulators, and semiconductors and effect on electrical conductivity of these materials based on their band structures. **SO3.3**Energy bands and Fermi level determine the electrical conductivity of different materials. **SO3.5** Fundamental principles of superconductivity, its types, critical magnetic fields, the Meissner effect, and the isotope effect. **SO3.5** Josephson effect involves the flow of super current across a weak link or junction between two superconductors. The role of phase difference and critical current in the behavior of a Josephson junction **SO3.6** The concept of flux quantization in the context of SQUIDs and how it is exploited for high sensitivity.	1.1To determine the energy band gap in a semiconductor using a p-n Junction diode. 1.2 To determine the hall coefficient (R_H) of a semiconductor material. 1.3 To plot and verify the characteristic curve of PN junction diode. 1.4To plot and verify the characteristic curve of zener junction diode. 1.5To study the characteristic curve of PNP transistor. 1.6 To study the characteristic curve of NPN transistor. 1.7 To study the variations of thermo emf of a copper-constantan thermo-couple with temperature.	**Unit-3:Solid State Physics and Superconductivity** **3.1**Statement of Bloch's function, Bands iii solids **3.2**velocity of Bloch's electron and effective mass **3.3**Distinction between metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, law of mass action **3.4** Determination of energy gap in semiconductors. Donors and acceptor levels. **3.5**Superconductivity, critical magnetic field, Meissner effect, Isotope effect **3.6** Type-I and II superconductors **3.7** Josephson's effect: DC and AC effect **3.8** Squids, Introduction to high T_c superconductors.	Understanding of splitting of various energy levels and differentiating conductors, semiconductors & insulators according to band gap energy. Understanding of basic electronic circuits and Ohm's law

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Superconductors and their types.
2. Classification of solid materials.

AE102 .4: Understanding the in-depth concepts pertaining to the various mechanisms involved for exhibiting laser light and detailed explanation of the formation of different types of Maser and Laser. Understanding of Holographic technique to produce 3D image of an object.

Approximate Hours

Item	AppXHrs
Cl	06
LI	04
SW	1
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Understand the interaction of matter with radiation and evaluate the characteristics of LASER **SO4.2** Remember the phenomena of LASER production **SO4.3** Analyse the working of a He - Ne laser and RUBY laser **SO4.4** Analyse the working of Ammonia and Ruby masers. **SO4.5** Understanding the fundamental principles of holography including interference and wave front reconstruction enable to describe the holographic recording and reconstruction processes. **SO4.6** Understanding the phenomenon if diffraction of light.	4.1 To determine the slit width from Fraunhofer diffraction pattern using laser beam 4.2 To find out the wave length of light by using spectrometer.	**Unit-4 : Laser** 4.1 Spontaneous and stimulated emission 4.2 Einstein A and B coefficients 4.3 Population inversion, He-Ne Laser 4.4 Ruby Laser 4.5 Ammonia and Ruby masers 4.6 Holography	Deep understanding of interaction of matter takes place and splitting of energy levels. Various phenomena of light.

SW-4Suggested Sessional Work (SW):

a. Assignments:

1. Laser and its properties.

2. Concept of Holography.

AE102.5: Understanding of structure and light propagation mechanism in an optical fiber and understanding the concept of illumination and its related terms.

Item	AppXHrs
CL	04
LI	02
SW	01
SL	01
Total	07

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Remember the fundamentals of optical fibers and analyze the usage of optical fiber as a wave guide . **SO5.2** Remember principle of propagation of light in optical fiber and Derive the expression for acceptance angle, Numerical aperture, Evaluate the different types of optical fibers. **SO5.3** Basic principles of light propagation in optical fibers, including total internal reflection and Snell's Law. **SO5.4**Comprehend concepts like color temperature, color rendering, luminance and luminance. **SO5.5**Understand the concept of luminous flux and its significance in describing the total visible light emitted by a source.	5.1 To find the numerical aperture of optical fiber: To set up the fiber optic analog and digital link.	**Unit 5: Optical fiber & Illumination** 5.1 Optical fiber, Physical structure, basic theory, Mode type 5.2 Input and output characteristics of optical fiber and its applications 5.3 Illumination: laws of illumination 5.4 Luminous flux, luminous Intensity, 5.5 candlepower & brightness.	Understanding the phenomenon of total internal reflection (TIR) and basic concept of optical fiber and illumination.

SW-5Suggested Sessional Work (SW):

a. Assignments:

1. Propagation of light in an optical fiber.
2. Illumination and laws of illumination.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE102.1. T o explainthehow magnetic domain effect and contribute to the overall magnetic behavior of a material. Understanding of the principles governing the behavior of magnetic materials, and they should be able to apply, analyze and solve problems related to magnetism in various contexts.	5	**0**	2	1	08
AE102.2. To understands and solve the Schrödinger equation for a free particle. A comprehensive understanding of the behavior of particles in one and three dimensions enabling them to analyze and solve problems in a wide range of quantum systems.	6	**0**	1	1	08
AE102.3. Understand the electronic band structures for different solid materials and phenomenon of superconductivity and effect of temperature on superconductors.	8	14	2	1	25
AE102.4. Understanding the in-depth concepts pertaining to the various mechanisms involved for exhibiting laser light and detailed explanation of the formation of different types of Maser and Laser. Understanding of Holographic technique to produce 3D image of an object.	6	4	1	2	13
AE102.5. Understanding of structure and light propagation mechanism in an optical fiber and understanding the concept of illumination and laws of illumination and its related terms.	5	**2**	1	1	9
Total Hours	30	20	7	6	63

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Magnetism**	03	01	01	05
CO-2	**Quantum Physics**	02	06	02	10
CO-3	**Solid State Physics & Superconductivity**	03	07	05	15
CO-4	**Laser**	-	10	05	15
CO-5	**Optical fiber & Illumination**	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Tractor System and Control 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Text book of Optics	Brijlal & Subramanian	S. Chand	2010
2	Text book of Engineering Physics	Navneet Gupta & S.K. Tiwary	**Dhanpat Rai Publication**	2012
3.	Text book of Engineering Physics	M.N. Avadhanulu and. P.G. Kshirsagar	S. Chand	2010
4	Engineering Mechanics	MK Harbola	Cengage Learning	2018
5	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna .			

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering

Course Code: 22PH122

Course Title: Engineering Physics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1 : To explain the how magnetic domain effect and contribute to the overall magnetic behavior of a material. Understanding of the principles governing the behavior of magnetic materials, and they should be able to apply, analyze and solve problems related to magnetism in various contexts.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : To understand and solve the Schrödinger equation for a free particle. A comprehensive understanding of the behavior of particles in one and three dimensions enabling them to analyze and solve problems in a wide range of quantum systems	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3 : Understand the electronic band structures for different solid materials and phenomenon of superconductivity and effect of temperature on superconductors.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Understanding the in-depth concepts pertaining to the various mechanisms involved for exhibiting laser light and detailed explanation of the formation of different types of Maser and Laser. Understanding of Holographic technique to produce 3D image of an object.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Understanding of structure and light propagation mechanism in an optical fiber and understanding the concept of illumination and laws of illumination and its related terms.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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 PSO1,2,3,4,5	CO-1:T o explain the how magnetic domain effect and contribute to the overall magnetic behavior of a material. Understanding of the principles governing the behavior of magnetic materials, and they should be able to apply, analyze and solve problems related to magnetism in various contexts.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Magnetism** 1.1,1.2,1.3,1.4,1.5	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 2 : To understand and solve the Schrödinger equation for a free particle. A comprehensive understanding of the behavior of particles in one and three dimensions enabling them to analyze and solve problems in a wide range of quantum systems.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6		Unit-2 **Quantum Physic** 2.1,2.2,2.3,2.4,2.5,2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO3: Understand the electronic band structures for different solid materials and phenomenon of superconductivity and effect of temperature on superconductors.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6 SO3.7 SO3.8	14	Unit-3:**Solid State Physics & Superconductivity** 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 4:Understanding the in-depth concepts pertaining to the various mechanisms involved for exhibiting laser light and detailed explanation of the formation of different types of Maser and Laser. Understanding of Holographic technique to produce 3D image of an object.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6	04	Unit-4 : **Laser** 4.1,4.2,4.3,4.4,4.5,4.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 5: Understanding of structure and light propagation mechanism in an optical fiber and understanding the concept of illumination and laws of illumination and its related terms.	SO5.1 SO5.2 SO5.3 SO5.4	02	Unit5: **Optical fiber & Illumination**. 5.1,5.2,5.3,5.4	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-I

Course Code:	**22CH123**
Course Title :	Engineering Chemistry
Pre- requisite:	Students must have fundamental knowledge of basic chemistry and laboratory safety
Rationale	The students studying engineering chemistry will explain and apply basic techniques related to water analysis, fuels and lubricants, polymers, bio molecules and spectroscopic techniques like IR, UV as well as TGA, DTA and DSC

AE103.1 Apply the concept of hardness of water, its units and identify temporary and permanent hardness

AE103.2: Describe the concept of fuels, lubricants, characteristics of good fuel, calorific value and determine of calorific value by bomb calorimeter.

AE103.3: Explain and apply the concept of classification of polymers, types of polymerization, mechanism of polymerization and determination of molecular weight of polymers.

AE 103.4 Explain the concept of properties and application of lipids, proteins, carbohydrates and vitamins

AE103.5: Apply principle of IR and UV-VIS spectroscopy and explain Analytical methods f like TGA, DTA and DSC, analytical applications of radioactive materials.

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)	
BSC	22CH123	Engineering Chemistry	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
BSC	22CH123	**Engineering Chemistry** **(Theory)**	0	15	15	0	0	30	50	80
		Engineering Chemistry **(Practical/Lab)**	15	0	0	5		20	0	20
		Total								**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.

AE103.1 Apply concept of hardness of water and its units and identify temporary and permanent hardness.

Approximate Hours

Activity	**AppX Hrs**
CL	6
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Discuss the types of hardness. **SO1.2** Explain the advantage and dis advantage of hard water. **SO1.3** Explain the corrosion and its prevent methods. **SO1.4** Solve the numerical problem of hardness.	1.1 Determination of water hardness by EDTA method 1.2 Determination of water alkalinity.	**Unit 1:** **Water and its industrial applications:** 1.1Hardness of water and its units, 1.2Temporary and permanent hardness 1.3 Disadvantages of hard water, scale 1.3 sludge formation in boilers 1.4 Corrosion: causes. Types and method of prevention. 1.5Boiler corrosion. 1.6 Numerical problems based on hardness of water.	1- Disadvantages of hard water, scale and sludge formation in boilers.

SW- Suggested Sessional Work (SW):

A .Assignments: Disadvantages of hard water, scale and sludge formation in boilers.

b. Mini Project: Report on Local or nearby water hardness

c. Other Activities (Specify): Pictorial presentation of sludge formation in boilers.

AE103.2: Describe the concept of fuels, lubricants, characteristics of good fuel, calorific value and determine of calorific value by bomb calorimeter

Approximate Hours

Activity	AppX Hrs
CL	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Describe the concept of classification of fuels. SO2.2explain characteristics of good fuel, calorific value and its units. SO2.3Determine calorific value by bomb calorimeter SO2.4Explain mechanism of lubricants.	1.1 Estimation of chloride in water: 1.2 Estimation of dissolved oxygen in water:	**Unit 2:- Fuel and Lubricant:** 2.1Introduction and classification of fuels, 2.2 characteristics of good fuel, 2.3 calorific value and its units 2.4 Determination of calorific value by bomb calorimeter, 2.5 properties of lubricants. 2.6 mechanisms of lubricants.	Significance of Lubricants

SW-2 Suggested Sessional Work (SW):

Assignments: A report on lubrication at higher temperature

Mini Project: Pictorial presentation of classification of fuels

Other Activities (Specify):

AE103.3: Explain and apply the concept of classification of polymers, types of polymerization, mechanism of polymerization and determination of molecular weight of polymers

Approximate Hours

Activity	AppX Hrs
CL	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Describe Introduction and classification of polymers SO3.2 Explain types of polymerization. SO3.3 Explain and apply mechanism of polymerization. SO3.4 Explain applications of polymers	1.1 Detection of extra element and functional group in given organic compound (carboxylic acid): 1.2 Detection of extra element and functional group in given organic compound (amide)	**Unit 3:- High Polymers**: 3.1Introduction and classification of polymers, 3.2 types of polymerization, 3.3Mechanism of polymerization. 3.4 determination of molecular weight of polymers. 3.5 Preparation, properties and uses of Nylon6,nylon 66, 3.6 Teflon, and PVC.	Polymers and their uses

SW-3 Suggested Sessional Work (SW):

Assignments Applications ofsynthetic polymers

Mini Project: A report on biodegradability of polymers

Other Activities (Specify):

AE103.4 Explain the concept of properties and application of lipids, proteins, carbohydrates and vitamins

Approximate Hours

Activity	AppX Hrs
CL	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Manufacturing of ethanol and acetic acid by fermentation methods. **SO4.2**Discuss the fundamental concept and its application of lipids, proteins, carbohydrates and vitamins. SO4.3 Apply fermentation process for production of ethanol SO4.4 Explain properties and applications of bimolecular	1.1 Detection of extra element and functional group in given organic compound (thio amide): 1.2 Estimation of chloride in water:	**Unit 4:- Enzymes and Bio Molecules:** 4.1 Enzymes and their use 4.2 manufacturing of ethanol by fermentation methods. 4.3 manufacturing of acetic acid by fermentation methods. 4.4 Introduction properties and application of lipids, 4.5. proteins, carbohydrates 4.6. vitamins	. Significance of bimolecular

SW-4 Suggested Sessional Work (SW):

A .Assignments: Fermentation and useful products

b. Mini Project: Significance of lipids, proteins, carbohydrates and vitamins.

AE103 .5: Apply principle of IR and UV-VIS spectroscopy and explain Analytical methods f like TGA, DTA and DSC, analytical applications of radioactive materials.

Approximate Hours

Activity	AppX Hrs
CL	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain importance of spectroscopy, electromagnetic radiation. **SO5.2** Explain the principle and application of IR and UV-VIS spectroscopy. **SO5.3** Explain Analytical methods in brief like TGA, DTA and DSC. **SO5.4** Apply spectroscopic and analytical technique	1.1 Verification of Beer- Lambert law 1.2 Determination of absorption maximum of a given organic compound.	**Unit 5:- Analytical methods and spectroscopy**: 5.1Introduction and importance of spectroscopy, electromagnetic radiation 5.2 Introduction principle and application of IR and UV-VIS spectroscopy 5.3TGA 5.4 DTA 5.5 DSC. 5.4 analytical applications of radioactive materials.	EMR and its interaction with ,matter *

SW-5 Suggested Sessional Work (SW):

A .Assignments:

Introduction and importance of spectroscopy, electromagnetic radiation.

b. Mini Project: Application of IR and UV-VIS spectroscopy

c. Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE103.1 Apply the concept of hardness of water, its units and identify temporary and permanent hardness.	6	4	1	1	12
AE103.2: Describe the concept of fuels, lubricants, characteristics of good fuel, calorific value and determine of calorific value by bomb calorimeter	6	4	1	1	12
AE103.3: Explain and apply the concept of classification of polymers, types of polymerization, mechanism of polymerization and determination of molecular weight of polymers.	6	4	1	1	12
AE 103.4 Explain the concept of properties and application of lipids, proteins, carbohydrates and vitamins	6	4	1	1	12
AE103.5: Apply principle of IR and UV-VIS spectroscopy and explain Analytical methods f like TGA, DTA and DSC, analytical applications of radioactive materials.	6	4	1	1	12
Total Hours	**30**	**20**	**5**	**5**	**60**

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Water and its industrial applications	03	01	01	05
CO-2	Fuel and Lubricant	02	06	02	10
CO-3	High Polymers	03	07	05	15
CO-4	Enzymes and Bio Molecules.	-	10	05	15
CO-5	Analytical methods and spectroscopy	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Organic Chemistry I will be held with writtenexamination 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to NCL, CSIR laboratories
7. Demonstration
8. CT 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	A textbook of engineering chemistry	Bahl B S, ArunBahl and Tuli B D.	Arun Bahl	Edition 2007
2	A Textbook of Engineering Chemistry	PC Jain and Monika Jain	Dhanpat Rai Prakashan	Edition1998

Suggested Web Sources:

1. https://nptel.ac.in/course.html
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5
3. https://swayam.gov.in/explorer?category=Chemistry

Mode of Delivery: Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point;

LMS/ICT Tools: Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

Curriculum Development Team:

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3. Mr.Khana Singh , Tiwari Assistant Professor, Department of Chemistry, AKS University
4. Dr.Shusma Singh Parihar, Assistant Professor, Department of Chemistry, AKS University

Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering
Course Code: 22CH123
Course Title: Engineering Chemistry

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution	Ability to use the research based innovative knowledge for sustainable
CO1 Apply the concept of hardness of water, its units and identify temporary and permanent hardness	3	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 Describe the concept of fuels, lubricants, characteristics of good fuel, calorific value and determine of calorific value by bomb calorimeter.	2	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3 Explain and apply the concept of classification of polymers, types of polymerization, mechanism of polymerization and determination of molecular weight of polymers.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Explain the concept of properties and application of lipids, proteins, carbohydrates and vitamin	2	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5 : Apply principle of IR and UV-VIS spectroscopy and explain Analytical methods f like TGA, DTA and DSC, analytical applications of radioactive materials.	2	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO1: Apply the concept of hardness of water, its units and identify temporary and permanent hardness	SO1.1 SO1.2 SO1.3 SO1.4	LI 1.1 LI1.2	Unit-1.0 **Water and its industrial applications:** 1.1,1.2,1.3,1.4,1.5,1.6	Disadvantages of hard water, scale and sludge formation in boilers.
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO2:** Describe the concept of fuels, lubricants, characteristics of good fuel, calorific value and determine of calorific value by bomb calorimeter.	SO2.1 SO2.2 SO2.3 SO2.4	LI 2.1 LI2.2	Unit-2 **Fuel and Lubricant** 2.1,2.2,2.3,2.4,2.5,2.6	Significance of Lubricants
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO3 Explain** and apply the concept of classification of polymers, types of polymerization, mechanism of polymerization and determination of molecular weight of polymers.	SO3.1 SO3.2 SO3.3 SO3.4	LI 3.1 LI3.2	Unit-3 **High Polymers** 3.1, 3.2,3.3,3.4,3.5,3.6	Polymers and their uses
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 4** Explain the concept of properties and application of lipids, proteins, carbohydrates and vitamins	SO4.1 SO4.2 SO4.3 SO4.4	LI 4.1 LI4.2	Unit-4 : : **Enzymes and Bio Molecules** 4.1, 4.2,4.3,4.4,4.5,4.6	Significance of bio molecules
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 5** Apply principle of IR and UV-VIS spectroscopy and explain Analytical methods f like TGA, DTA and DSC, analytical applications of radioactive materials.	SO5.1 SO5.2 SO5.3 SO5.4	LI 5.1 LI5.2	**Unit 5: Analytical methods and spectroscopy:** 5.1,5.2,5.3,5.4,5.5,5.6	EMR and its interaction with ,matter

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-I

Course Code:	**22ME124**
Course Title :	**Thermodynamics , Refrigeration and Air conditioning**
Pre- requisite:	Basic understanding of physics, including thermodynamic principles and gas laws. Familiarity with engineering concepts and mathematical calculations is beneficial.
Rationale	The syllabus equips students with fundamental principles of thermodynamics and refrigeration, preparing them for practical applications in air conditioning and refrigeration systems, emphasizing both theoretical understanding and hands-on skills essential for engineering practice.

Course Outcomes:

AE 104.1: Analyze thermodynamic properties and laws to solve problems in heating, expansion, and steady flow processes.

AE 104.2: Evaluate the efficiency of different cycles like Carnot, Otto, diesel, and dual cycles, applying entropy principles.

AE 104.3: Apply refrigeration principles to design systems using various cycles and refrigerants, including absorption refrigeration.

AE 104.4: Design and analyze refrigeration systems, including cold storage plants, and understand psychrometrics for air conditioning applications.

AE 104.5: Demonstrate proficiency in air conditioning principles, design methods, load calculations, and equipment selection for diverse applications.

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)	
ESC	**22ME124**	**Thermodynamics , Refrigeration and Air conditioning**	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
ESC	**22ME124**	**Thermodynamics , Refrigeration and Air conditioning**	0	15	15	0	0	30	50	80
		Thermodynamics , Refrigeration and Air conditioning-LAB	15	0	0	5		20	0	20
		Total								**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.

AE 104.1: Analyze thermodynamic properties and laws to solve problems in heating, expansion, and steady flow processes.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO1.1 Analyze closed and open systems, applying thermodynamic principles effectively. **SO1.2** Demonstrate comprehension of gas laws and laws of thermodynamics. **SO1.3** Apply the first law of thermodynamics to heating processes and gas expansion. **SO1.4** Interpret internal energy variations in different thermodynamic processes. **SO1.5** Apply the first law to analyze steady flow processes efficiently. .	1.1 Tutorials on thermodynamic air standard otto cycles, 1.2 Tutorials on thermodynamic air standard diesel cycles,	1.1 Thermodynamics properties, closed and open system, flow and non-flow processes, 1.2 gas laws, 1.3 laws of thermodynamics, internal energy. 1.4 Application of first law in heating and expansion of gases in non-flow processes. 1.5 First law applied to steady flow processes. 1.6 Numerical Solving	1. Different conditions of equilibrium 2. Thermodynamic System, Surrounding and Boundary, Control Volume approach and Systems approach

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i) Equilibrium – Thermal ,Chemical, Mechanical and thermodynamic

ii) Zeroth Law of Thermodynamics, Energy, sources of energy forms of energy, Energy transfer by work and forms of work

b. Mini Project:

i) Verify first law of thermodynamics in heating and expansion processes using simple apparatus. Discuss findings.

AE 104.2: Evaluate the efficiency of different cycles like Carnot, Otto, diesel, and dual cycles, applying entropy principles.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	6
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
S02.1 Understand the Carnot cycle and its significance in thermodynamics. **S02.2** Apply the Carnot theorem to analyze efficiency and limitations of heat engines. **S02.3** Explain entropy and its physical significance in thermodynamic systems. **SO2.4** Calculate entropy changes in gas processes, interpreting their thermodynamic implications. **SO2.5**Compare and contrast Otto, Diesel, and dual cycles, analyzing their efficiency and practical applications.	2.1Numerical on design of air conditioning systems, 2.2 Study of window air conditioner, 2.3 Study on repair and maintenance of refrigeration and air-conditioning systems.	2.1 Carnot cycle, Carnot theorem. 2.2 Entropy, physical concept of entropy, change of entropy of gases in thermodynamics process. 2.3 Otto Cycle 2.4 Diesel Cycle 2.5 Dual cycle 2.6 Numerical Solving	1. Limitation of first law of thermodynamics, Thermal Reservoir – Source and Sink.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i) Concept of Heat Engine, Heat Pump and Refrigerator

ii) Reversible and Irreversible Process

b. Mini Project:

i) Visit the thermal power plant and Manufacturing factory and prepare a report.

AE 104.3: Apply refrigeration principles to design systems using various cycles and refrigerants, including absorption refrigeration..

Approximate Hours

Item	AppX Hrs
Cl	6
LI	8
SW	1
SL	1
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO3.1 Understand refrigeration principles, units, and terminology effectively. **SO3.2** Explore low temperature production and air refrigeration cycles. **SO3.3** Analyze vapor refrigeration mechanisms using P-V diagrams. **SO3.4** Evaluate vapor compression cycles, dry/wet compression, super/subcooling. **SO3.5** Grasp vapor absorption refrigeration systems and their components.	3.1 Study and application of P V and T S chart in refrigeration, 3.2 P H chart (or) Mollier diagram in refrigeration, 3.3Numerical on air refrigeration cycle systems, 3.4 Numerical on vapour compression cycle refrigeration system,	3.1 Principles of refrigeration, - units, terminology, 3.2 production of low temperatures, 3.3 Air refrigerators working on reverse Carnot cycle and Bell Coleman cycle. 3.4 Vapour refrigeration-mechanism, P-V,P-S,P-H diagrams, 3.5 vapor compression cycles, dry and wet compression, super cooling and sub cooling. 3.6 Vapour absorption refrigeration system.	1.Investigate and list the practical limitations of implementing the reversed Carnot cycle in real-world refrigeration systems.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i.Describe the Reversed Carnot Cycle and its significance in refrigeration systems. Explain its practical limitations and why it cannot be achieved in real-world applications.

b. Mini Project:

i. Analyze efficiency of vapor compression refrigeration system through experimental setup and theoretical calculations.

AE 104.4: Evaluate the performance of power transmission elements like belts, gears, and screw motion mechanisms in mechanical design.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	6
SW	2
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO4.1 Identify refrigerants and properties. **SO4.2** Apply design calculations in refrigeration systems. **SO4.3** Analyze cold storage plant operations. **SO4.4** Utilize thermodynamic properties of moist air for calculations. **SO4.5** Interpret psychometric chart for basic psychometric processes.	4.1 Study of domestic water cooler, 4.2 Study of domestic household refrigerator, 4.3 Study of absorption type refrigeration system,	4.1 Common refrigerants and their properties. 4.2 Design calculations for refrigeration system. Cold storage plants. 4.3 Thermodynamic properties of moist air, 4.4 perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, 4.5 psychometric chart and its use, 4.6 elementary psychometric process.	1. Psychrometric principles in creating healthier living and working environments 2.Impact of psychrometry on agriculture or industrial processes beyond HVAC

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Describe the construction and use of a psychometric chart for analyzing the properties of moist air. Explain how to read and interpret a psychometric chart, including the representation of psychometric processes and the calculation of various psychometric properties.

AE 104.5: Select and apply suitable anti-friction bearings for machine design applications, considering load and speed requirements.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	6
SW	2
SL	2
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO5.1 Understand air conditioning types and functions. **SO5.2** Apply physiological principles in air conditioning design. **SO5.3** Design air distribution systems and ducts effectively. **SO5.4** Calculate cooling loads and size humidifiers/dehumidifiers accurately. **SO5.5** Select appropriate air conditioning systems for diverse applications.	5.1 Study cold storage for fruit and vegetables, 5.2 Freezing load and time calculations for food materials, 5.3 Determination of refrigeration parameters using refrigeration tutor – II	5.1 Air conditioning – principles –Type and functions of air conditioning, 5.2 physiological principles in air conditioning, 5.3 air distribution and duct design methods, 5.4 fundamentals of design of complete air conditioning systems – 5.5 humidifiers and dehumidifiers – cooling load calculations, 5.6 types of air conditioners – applications.	1.Selection guidelines for supply air conditions. 2.impact of ventilation

SW-4 Suggested Sessional Work (SW):

a) **Assignments:**

i) Explore the heat balance equation and its application in assessing thermal comfort. Discuss the components of the heat balance equation, including metabolic heat production, sensible heat exchange, and latent heat exchange.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+ SW+SL)
AE 104.1: Analyze thermodynamic properties and laws to solve problems in heating, expansion, and steady flow processes.	6	4	1	1	12
AE 104.2: Evaluate the efficiency of different cycles like Carnot, Otto, diesel, and dual cycles, applying entropy principles.	6	6	1	1	14
AE 104.3: Apply refrigeration principles to design systems using various cycles and refrigerants, including absorption refrigeration	6	8	1	1	16
AE 104.4: Design and analyze refrigeration systems, including cold storage plants, and understand psychrometrics for air conditioning applications.	6	6	2	1	15
AE 104.5Demonstrate proficiency in air conditioning principles, design methods, load calculations, and equipment selection for diverse applications.	6	6	2	2	16
Total Hours	30	30	7	6	73

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

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CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Thermodynamic Systems and Gas Laws	02	05	03	10
CO-2	Carnot Cycle and Entropy	02	05	03	10
CO-3	Refrigeration Principles and Systems	02	04	04	10
CO-4	Refrigerants and Refrigeration Design	02	05	03	10
CO-5	Air Conditioning Fundamentals and Design	02	05	03	10
Total		10	24	16	50

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

The end of semester assessment for Thermodynamics, Refrigeration and Air conditioning 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to tractor testing Institute (Bhudni, Bhopla , M.P.)
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) **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.	Refrigeration And Air Conditioning	C.P. Arora	Tata McGraw-Hill	
4.	Refrigeration And Air Conditioning	R.K. Rajput	Katson Publication	
5.	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22ME124

Course Title: THERMODYNAMICS, REFRIGERATION AND AIR CONDITIONING

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO:1- Analyze thermodynamic properties and laws to solve problems in heating, expansion, and steady flow processes.	2	2	2	2	2	2	3	1	1	1	1	1	2	3	3	2
CO:2- Evaluate the efficiency of different cycles like Carnot, Otto, diesel, and dual cycles, applying entropy principles. processes.	3	2	2	3	3	2	2	1	2	1	1	1	2	3	2	2
CO:3- Apply refrigeration principles to design systems using various cycles and refrigerants, including absorption refrigeration.	3	3	2	2	2	2	2	1	1	2	1	1	1	2	3	2
CO:4- Design and analyze refrigeration systems, including cold storage plants, and understand psychrometrics for air conditioning applications.	3	3	2	3	2	2	2	1	2	2	1	1	3	3	3	2
CO:5- Demonstrate proficiency in air conditioning principles, design methods, load calculations, and equipment selection for diverse applications.	3	3	2	3	2	2	2	1	1	1	1	1		3	2	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	CO:1- Analyze thermodynamic properties and laws to solve problems in heating, expansion, and steady flow processes.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1 LI1.2	**Unit-1. Thermodynamic Systems and Gas Laws** 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO:2- Evaluate the efficiency of different cycles like Carnot, Otto, diesel, and dual cycles, applying entropy principles. processes.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1 LI2.2 LI2.3	**Unit-2 Carnot Cycle and Entropy** 2.1, 2.2, 2.3, 2.4, 2.5,2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO:3- Apply refrigeration principles to design systems using various cycles and refrigerants, including absorption refrigeration.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1 LI3.2 LI3.3 LI3.4	**Unit-3 : Refrigeration Principles and Systems** 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO:4- Design and analyze refrigeration systems, including cold storage plants, and understand psychrometrics for air conditioning applications.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1 LI4.2 LI4.3	**Unit-4 : Refrigerants and Refrigeration Design** 4.1, 4.2, 4.3, 4.4, 4.5,4.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO:5- Demonstrate proficiency in air conditioning principles, design methods, load calculations, and equipment selection for diverse applications.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI5.1 LI5.2 LI5.3	**Unit-5 : Air Conditioning Fundamentals and Design** 5.1, 5.2, 5.3, 5.4, 5.5,5.6	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-I

Course Code:	22CE125
Course Title:	Surveying and levelling
Pre- requisite:	Student should have basic knowledge of maps, filed measurement and its reequipment.
Rationale:	The students studying Agricultural Engineering should possess foundational understanding about historical brief knowledge of surveying and levelling. This encompasses familiarity with the invention and evolution of surveying and leveling and its numerical for field work observation. Additionally, students think too acquire fundamental insights into various surveying and leveling.

Course Outcomes:

AE 105.1: Understand a solid foundation in the fundamental principles and concepts of surveying, including the geometry of measurements, coordinate systems, and basic surveying instruments.

AE105.2: Acquired the knowledge of types compass and measure ring the bearing through compass and filed area measurement.

AE105.3: Understanding and acquired the knowledge of plane tables survey, along with its various methods and its accessories.

AE105.4: Students should be capable of creating topographic maps and plans using survey data, contour lines, and elevation data.

AE105.5: Students should become proficient in the use of surveying instruments such as total stations, thedoilite, levels, and GPS equipment. Imparts the knowledge on modern surveying instruments.

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)	
ESC	22CE125	SURVEYING AND LEVELLING	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

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test2 (2 best out of 3) 10 marks each (CT)	Seminarr one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
ESC	22CE125	SURVEYING AND LEVELLING **(Theory)**	0	15	15	0	0	30	50	80
		SURVEYING AND LEVELLING **(Practical/ Lab)**	15	0	0	5	**0**	20	0	20
			Total							**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.

AE 105.1: Understand a solid foundation in the fundamental principles and concepts of surveying, including the geometry of measurements, coordinate systems, and basic surveying instruments.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	04
SW	02
SL	2
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand Surveying Introduction, classification and basic principles **SO1.2** knowing the different types of chain and its field measurement. **SO1.3** understanding the concept of survey station and lines. **SO1.**4 analyze the Type of chain and its recording. **SO1.**5 analyze and apply the error occurs in chain measurement. .	1- Introduction to different survey chains. 2- Chain survey of an area and preparation of map.	**Unit-1.0 Surveying – Introduction, classification and basic principles.** 1.1 Linear measurements 1.2 Chain surveying – definition 3 Selection of survey station and lines, types of ranging & chaining types of chains, recording the measurement. Errors in measurements, their elimination and correction. Offset measurement, cross staff optical square. prism square, obstacles in chaining and ranging	1. surveying classification its uses in daily life. 2. Brief explore to types of chain and its measurements in field survey.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Define the prism square and its uses in chaining and ranging

ii. Write the basic principle of surveying.

b. Mini Project

i. To make a diagram of different types of chains.

AE 105.2: knowledge to measure the angles through compass and filed area measurement.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	02
SW	02
SL	02
Total	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1 To Understand the Types and Methods of Traverse survey. **SO2.2** To learn about angle observation and measurement. **SO2.3** To understand the Prismatic Compass, Surveyor Compass, Bearing of line, and computation of angles. **SO2.4** To understand the Local attraction and numerical **SO2.**5 To understand the filed area measurement and solving of numerical problem	1- Compass survey of an area and plotting of compass survey.	Unit-2 **Methods of traversing.** **2.1** prismatic and surveyors compass angle and bearing **2.2** quadrental system **2.3** local attraction magnetic declination dip traversing plotting bow ditch rule, transit rule errors in compass survey their elimination and correction	i. explanation of compass survey and bearing system ii. Formation of local attraction and its properties

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the bearing system and its types with suitable figure.
ii. Bow ditch rule numerical problem for traverse area correction.

b. Mini Project:

Marking of low local attraction area for better compass survey observation.

AE 105. 3: Understanding and acquired the knowledge of plane tables survey, along with its various methods and its accessories.

Approximate Hours

Item	AppX Hrs
Cl	4
LI	2
SW	1
SL	2
Total	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CL)**	**Self Learning (SL)**
SO3.1 To understand the basic concept of plane table survey. **SO3.2** types of instrument or accessories used for plane table survey. **SO3.3** knowing the different types of methods of plane table survey. **SO3.4** Properties and use of two points problem. **SO3.**5 Properties and Use of three points problem	1. -Plane table survey by using radiation method and intersection method	**Unit-3 :** Plane table surveying – instruments 3.1 Accessories, methods. 3.2 principle two points, three points problems 3.3 errors in plane tabling, minor instruments, elinometer, sextant, planimeter	i. learn basic specification of planimeter. ii. Advantages of plane table survey.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

iii. What are minor instruments? Explain the Elinimeter, sextant with suitable figure.

b. Mini Project:

Making a draw of different plane table survey methods in field observation.

AE 105.4: Students should be capable of creating topographic maps and plans using survey data, contour lines, and elevation data.

Approximate Hours

Item	AppX Hrs
Cl	3
LI	4
SW	2
SL	2
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 To understand the basic concept of levelling. **SO4.2** Understanding the basic principle and various method of levelling **SO4.3** Understanding the difficulties occurs in Leveling **SO4.4** understand the error in leveling. **SO4.**5 To understand the basic concept of contour and knowing the concept of area of volume.	1-Leveling. L-section and X-sections and its plotting. 2. -Contour survey of an area and preparation of contour map.	Unit-4: Leveling 4.1 Basic definitions, Brief about principles and methods of leveling. 4.2 Leveling difficulties, Brief of error in leveling. 4.3Contouring Introduction, importance of contouring Computation of area and volume	i. Preparation of process flow chart of leveling operations of agriculture field. ii. Draw a typical elevation map of agriculture field.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Write the different type of leveling with suitable figure.

ii. Describe briefly the different type of method of countering.

b. Mini Project:

i. To create the elevation difference counter map.

AE 105.5: **Students should become proficient in the use of surveying instruments such as total stations, thedoilite, levels, and GPS equipment. Imparts the knowledge on modern surveying instruments.**

Item	AppX Hrs
Cl	3
LI	4
SW	2
SL	2
Total	11

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 overview of theodolite instrument and measurement of vertical angle. **SO5.2** Over view of ranging **SO5.3** Role of the temporary and adjustment theodolite survey. **SO5.4** Overview off setting of curve. **SO5.**5 Basic requirement for setting up a GPS survey.	1. Theodolite surveying; Ranging by theodolite, Height of object by using theodolite. 2. -Uses of GPS and total station.	**Unit 5: Advance surveying technology:** 5.1 Theodolite traversing, Ranging by theodolite 5.2 Temporary and permanent adjustment of theodolite, Introduction to setting of curves 5.3 Introduction to GPS survey, Introduction to GIS Remote sensing and its applications. .	1.To know the measurement of vertical and horizontal angle by theodolite survey. 2.Explore the application of GPS application in Agricultural engineering.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- List the 10 spots points in GPS ground control point in AKSU campus.
- Explain the various application of remote sensing and GIS in agricultural Engineering.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Session alWork (SW)	Self Learning (SL)	Total hour (CL+ SW+SL)
AE 105.1: Understand a solid foundation in the fundamental principles and concepts of surveying, including the geometry of measurements, coordinate systems, and basic surveying instruments	3	4	2	11
AE 105.2: Acquired the knowledge of types compass and measure ring the bearing through compass and filed area measurement.	3	2	2	9
AE 105.3: Understanding and acquired the knowledge of plane tables survey, along with its various methods and its accessories.	4	2	1	9
AE 105.4: Familiarize with Familiarize with Students should be capable of creating topographic maps and plans using survey data, contour lines, and elevation data.	3	4	2	11
AE 105.5: Students should become proficient in the use of surveying instruments such as total stations, thedoilite, levels, and GPS equipment. Imparts the knowledge on modern surveying instruments.	3	4	2	11
Total Hours	**16**	**16**	**9**	**51**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Surveying	01	04	04	9
CO-2	compass	02	04	04	10
CO-3	Plane table surveying	2	04	05	11
CO-4	Levelling, Contouring	02	08	05	15
CO-5	Advance surveying technology	03	02	-	05
Total		10	22	18	50

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

The end of semester assessment for Surveying and leveling 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
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	Surveying & Leveling	B.C.Punamia	Lakshmi Publication, New Delhi.	Vol.-I;
2	Surveying and Levelling	Kanetkar, T.P. and Kulkarni, S.P. 1965	A.V. Griha Prakashan, Pune-4.	1965
3	Surveying and Leveling	Agor, R.	Khanna Publishers, New Delhi	1998
4	A text book of Surveying	C.L Kochher	Dhanpat Rai Publishing Company(P) Ltd. New Delhi	Revised edition 2013
5	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
6	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			
7				

Curriculum Development Team

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22CE125

Course Title: Surveying and leveling

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE 105.1: Understand a solid foundation in the fundamental principles and concepts of surveying, including the geometry of measurements, coordinate systems, and basic surveying instruments	1	1	3	2	3	2	3	2	2	1	3	2	2	3	3	3
AE 105.2: Acquired the knowledge of types compass and measure ring the bearing through compass and filed area measurement.	1	1	2	3	1	2	3	2	1	1	2	2	3	2	2	1
AE 105.3: Understanding and acquired the knowledge of plane tables survey, along with its various methods and its accessories.	2	2	1	1	1	2	3	2	1	2	1	2	1	1	3	2
AE 105.4: Familiarize with Familiarize with Students should be capable of creating topographic maps and plans using survey data, contour lines, and elevation data.	3	2	1	2	3	2	3	2	2	1	2	3	3	3	3	2
AE 105.5: Students should become proficient in the use of surveying instruments such as total stations, thedoilite, levels, and GPS equipment. Imparts the knowledge on modern surveying instruments.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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: Understand a solid foundation in the fundamental principles and concepts of surveying, including the geometry of measurements, coordinate systems, and basic surveying instruments	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	**As Mentioned along with the concern units**	Unit-1.0 Surveying 1.1,1.2,1.3,1.4,1.5,1.6,1.7	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Acquired the knowledge of types compass and measure ring the bearing through compass and filed area measurement.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Compass 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9,2.10	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3 : Understanding and acquired the knowledge of plane tables survey, along with its various methods and its accessories	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Plane Table Surveying 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Familiarize with Familiarize with Students should be capable of creating topographic maps and plans using survey data, contour lines, and elevation data.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Countering, Leveling 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Students should become proficient in the use of surveying instruments such as total stations, thedoilite, levels, and GPS equipment. Imparts the knowledge on modern surveying instruments.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Advance surveying technology. 5.1,5.2,5.3,5.4,5.5	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-I

Course Code:	**22ME175**
Course Title:	Engineering Drawing
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:	The students studying Graphics are essential in mechanical engineering, allowing engineers to visualize and communicate complex ideas clearly and concisely. Using graphics, engineers can create detailed plans for construction projects, analyses structural components, and convey design concepts to clients and stakeholders.

Course Outcomes:

AE 106.1: Apply first and third angle projection methods effectively, demonstrating understanding of drawing scales and principles of orthographic projections

AE 106.2: Proficiently utilize reference planes to determine points and lines in space, along with auxiliary planes for true shapes of oblique surfaces.

AE 106.3: Demonstrate competence in isometric projection, surface development of solids, and preparation of working drawings.

AE 106.4: Exhibit proficiency in creating sectional drawings of machine parts and understanding riveted joints and welding symbols.

AE 106.5: Demonstrate mastery in identifying and representing various types of threads, nuts, bolts, screws, and fasteners.

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)	
ESC	**22ME175**	**Engineering Drawing (LAB)**	0	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: 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 Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
ECS	**22ME175**	**Engineering Drawing (LAB)**	30	0	0	10	10	50	50	100
		Total								**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), culminatingin the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AE 106.1: Apply first and third angle projection methods effectively, demonstrating understanding of drawing scales and principles of orthographic projections

Approximate Hours

Item	AppX Hrs
Cl	0
LI	8
SW	0
SL	1
Total	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Master drawing scales and employ first and third angle projection methods proficiently. SO1.2 Apply principles of orthographic projection accurately in technical drawings. SO1.3 Understand the significance of drawing scales in engineering design and drafting. SO1.4 Demonstrate competency in selecting appropriate projection methods for different design requirements. SO1.5 Practice precision in representing three-dimensional objects on two-dimensional surfaces using projection methods.	**Unit-1.0 Introduction of Drawing Scales; First and Third Angle Methods of Projection Practice of Following** **1.1** Principles of orthographic projections **1.2** Elements of projection- object, projector, plane of projection, observer. **1.3** Different quadrants 1.4 First and third angle methods of projection.		1.Point Projection in different co-ordinate

SW-1 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

AE 106.2: Proficiently utilize reference planes to determine points and lines in space, along with auxiliary planes for true shapes of oblique surfaces.

Approximate Hours

Item	AppX Hrs
Cl	0
LI	10
SW	1
SL	2
Total	13

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1 Identify reference planes and determine points and lines in three-dimensional space. SO2.2 Interpret traces of lines and planes to visualize complex spatial relationships. SO2.3 Utilize auxiliary planes effectively to derive true shapes of oblique surfaces. SO2.4 Calculate true length and inclination of lines accurately in technical drawings. SO2.5 Apply reference planes conceptually to streamline the drafting process and improve accuracy.	**Unit-2.0 Reference Planes; Points and Lines in Space; Traces of Lines and Planes Practice of Following** 2.1 Auxiliary planes and true shapes of oblique plain surface; 2.2 True length and inclination of lines **2.3** Projections of solids (Change of position method, alteration of ground lines) 2.4 Section of solids 2.5 Interpenetration of solid surfaces;		1. Projection of Straight Line in different Position w.t.r. H.P. & V.P. 3. Projection of solid in different Position w.t.r. H.P. & V.P.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Projection of point & Projection of Straight Line

AE 106.3: Demonstrate competence in isometric projection, surface development of solids, and preparation of working drawings.

Approximate Hours

Item	AppX Hrs
Cl	0
LI	12
SW	3
SL	3
Total	18

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Master surface development techniques for various geometrical solids. SO3.2 Create isometric projections that accurately represent the three-dimensional structure of solids. SO3.3 Generate working drawings from models and isometric views proficiently. SO3.4 Demonstrate skill in drawing missing views to complete technical illustrations effectively. SO3.5 Apply different methods of dimensioning accurately to ensure clear communication in technical drawings.	**Unit-3.0 Development of Surfaces of Geometrical Solids; Isometric Projection of Geometrical Solids** **Practice of Following** 3.1 Isometric projection of geometrical solids 3.2 Preparation of working drawing from models 3.3 isometric views 3.4 Drawing of missing views 3.5 Different methods of dimensioning 3.6 Concept of sectioning		1. Development and sectioning of cylinder 2. Development and sectioning of prism 3. Draw Isometric view of plane and solid

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Draw three problems of projection of plane
ii. Draw three problems of projection of solid

b. Mini Project:

Make models of plane and solid by thermocol

AE 106.4: Exhibit proficiency in creating sectional drawings of machine parts and understanding riveted joints and welding symbols.

Approximate Hours

Item	AppX Hrs
Cl	0
LI	10
SW	0
SL	1
Total	11

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Create sectional drawings of machine parts using revolved and oblique sections. SO4.2 Identify types of rivet heads and understand principles of riveted joints. SO4.3 Demonstrate knowledge of processes for producing leak-proof joints in engineering applications. SO4.4 Interpret symbols for different types of welded joints accurately in technical drawings. SO4.5 Apply principles of sectional drawing to represent machine parts accurately in engineering design.	**Unit-4.0 Revolved and Oblique Sections; Sectional Drawing of Simple Machine Parts** **Practice of Following** 4.1 Revolved and oblique sections 4.2 Sectional drawing of simple machine parts 4.3 Types of rivet heads 4.4 riveted joints 4.5 Processes for producing leak proof joints		1. Symbols for different types of welded joints

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

AE 106.5: Demonstrate mastery in identifying and representing various types of threads, nuts, bolts, screws, and fasteners

Approximate Hours

Item	AppX Hrs
Cl	0
LI	18
SW	0
SL	1
Total	19

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 Identify and apply nomenclature for different types of threads effectively. SO5.2 recognizes various thread profiles and understands principles of multi-start threads. SO5.3 Demonstrate proficiency in representing nuts, bolts, and fasteners in technical drawings. SO5.4 Utilize conventional representations to depict threads accurately in engineering designs. SO5.5 Interpret different types of lock nuts, studs, machine screws, and wood screws in technical drawings.	**Unit-5.0 Nomenclature; Thread Profiles; Multi-Start Threads; Nuts, Bolts, and Fasteners** **Practice of Following** 5.1 Nomenclature, thread profiles 5.2 multi start threads, left and right hand threads 5.3 Square headed and hexagonal nuts and bolts. **5.4** Conventional representation of threads **5.5** Different types of lock nuts, studs **5.6** machine screws, cap screws and wood screws **5.7** Foundation bolts. Forms of screw threads **5.8** representation of threads, **5.9** stud screws, set screws, **5.9** **keys**-types, taper, rank taper, hollow saddle etc.		1. Bolts- hexagonal and square

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (CL+LI+SW+SI)
AE 106.1: Apply first and third angle projection methods effectively, demonstrating understanding of drawing scales and principles of orthographic projections.	0	8	0	1	9
AE 106.1.2: Proficiently utilize reference planes to determine points and lines in space, along with auxiliary planes for true shapes of oblique surfaces.	0	10	1	2	13
AE 106.1.3: Demonstrate competence in isometric projection, surface development of solids, and preparation of working drawings.	0	12	3	3	18
AE 106.1.4: Exhibit proficiency in creating sectional drawings of machine parts and understanding riveted joints and welding symbols.	0	10	0	1	11
AE 106.1.5: Demonstrate mastery in identifying and representing various types of threads, nuts, bolts, screws, and fasteners.	0	18	0	1	19
Total Hours	**0**	**58**	**4**	**8**	**70**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction of Drawing Scales; First and Third Angle Methods of Projection	03	01	01	05
CO-2	Reference Planes; Points and Lines in Space; Traces of Lines and Planes	02	06	02	10
CO-3	Development of Surfaces of Geometrical Solids; Isometric Projection of Geometrical Solids	03	07	05	15
CO-4	Revolved and Oblique Sections; Sectional Drawing of Simple Machine Parts	-	10	05	15
CO-5	Nomenclature; Thread Profiles; Multi-Start Threads; Nuts, Bolts, and Fasteners	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Engineering Graphics & 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Drawing	Bhatt N.D., Panchal V.M. & Ingle P.R.,	Charotar Publishing House	1999
2	Engineering Drawing	R.K. Dawan	S. Chand Publication.	1985
3	Engineering Drawing	Agrawal and Agrawal	TMH	2018
4	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

Curriculum Development Team

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Cos, POs and PSOs Mapping

Course Title: B. Tech Agricultural Engineering

Course Code: ESC 102

Course Title: Engineering Graphics and Design

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1 Engineering knowledge	**PO2** Problem analysis	**PO3** Design/development of solutions	**PO4** Conduct investing actions of complex problems	**PO5** Modern tool usage	**PO6** The engineer and society	**PO7** Environment and sustainability	**PO8** Ethics	**PO9** Individual and team work:	**PO10** Communication	**PO11** Project management and finance	**PO12** Life-long learning	**PSO 1** To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	**PSO 2** To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	**PSO 3** To inculcate entrepreneurial skills through strong Industry-Institution linkage.	**PSO 4** Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO 1: Apply first and third angle projection methods effectively, demonstrating understanding of drawing scales and principles of orthographic projections.	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2: Proficiently utilize reference planes to determine points and lines in space, along with auxiliary planes for true shapes of oblique surfaces.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3: Demonstrate competence in isometric projection, surface development of solids, and preparation of working drawings.	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: Exhibit proficiency in creating sectional drawings of machine parts and understanding riveted joints and welding symbols.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Demonstrate mastery in identifying and representing various types of threads, nuts, bolts, screws, and fasteners.	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	**CO 1:** Apply first and third angle projection methods effectively, demonstrating understanding of drawing scales and principles of orthographic projections	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI 1.1 LI 1.2 LI 1.3 LI 1.4		**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 2:** Proficiently utilize reference planes to determine points and lines in space, along with auxiliary planes for true shapes of oblique surfaces.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI 2.1 LI 2.2 LI 2.3 LI 2.4 LI 2.5		
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO3:** Demonstrate competence in isometric projection, surface development of solids, and preparation of working drawings.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI 3.1 LI 3.2 LI 3.3 LI 3.4 LI 3.5 LI 3.6		
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 4:** Exhibit proficiency in creating sectional drawings of machine parts and understanding riveted joints and welding symbols.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI 4.1 LI 4.2 LI 4.3 LI 4.4 LI 4.5		
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**CO 5:** Demonstrate mastery in identifying and representing various types of threads, nuts, bolts, screws, and fasteners.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI 5.1 LI 5.2 LI 5.3 LI 5.4 LI 5.5 LI 5.6 LI 5.7 LI 5.8 LI 5.9		

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme
Semster – I

Course Code:	22SC126
Course Title :	Principles of Soil Science
Pre- requisite:	Student should have basic knowledge of Rocks, Minerals, and different types of plant essential nutrients.
Rationale:	The students studying the difference between soil and land. Formation and distribution of soil on basis of agro-climatic zones of India. The various physical chemical and biological properties of soil in surface and subsurface of soil. Factors affection soil formation and nutrient availability. Role of various nutrients present in soil for growth and development of crop.

Course Outcomes:

AE107.1 To learn the general introduction of soil, classification, components, rocks, formation and weathering and its profile.

AE107.2 To understand the major factors affecting the process of weathering. Soil physical properties of different soil types of various locations of India, there colour variations, nutrient content and physical, chemical and biological variation.

AE107.3 To interpret the soil-water plant relationship and factors affecting them. Soil/Air, its distribution with respect to soil and earth. Soil temperature, availability of different types of microbes in different temperature.

AE107.4 To identify various soil cations, anaions, Silicate clay structures, and colloids. To be able to classify the different microbes present in soil.

AE107.5 The course aims to equip participants with a comprehensive understanding of utilizing saline and sodic water for crop production, emphasizing strategies to mitigate adverse effects on soil and plants.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week) CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	Total Credits (C)
Basic Science (BSC)	22SC126	Principles of Soil Science	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
BSC	**22SC126**	**Principles of Soil Science (Theory)**	0	15	15	0	0	30	50	80
		Principles of Soil Science (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE107.1 To learn the general introduction of soil, classification, components, rocks, formation and weathering and its profile.

Approximate Hours

Item	Appx. Hrs
CL	5
LI	4
SW	2
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1:To develop the general Introduction of soil, its components and classification of soil SO1.2: To distinguish various types of rocks and Composition of minerals in it. SO1.3: To understand the Weathering processes involved in formation of soil and factors affecting it. SO1.4: To discuss the Soil profile and its formation.	1. To study the soil profile In field To study the soil sampling tools, Processing and collection representative samples. 2. To study about the soil forming rocks and minerals	**Unit-1.0 Fundamentals of Soil Science** 1.1 To discuss about the Soil, its classification 1.2 To identify the various components of soil and its distribution in India and world. 1.3 To identify the various processes involved in formation of various horizons of soil profile. 1.4 To understand the various process involved in formation of soil from Rocks and Minerals. 1.5 Distribution of soil on basis of availability of Rocks and minerals in India	1. Composition of earth and various horizons of soil profile 2. Types of rock and composition of minerals in it

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Classification and Types of rocks and minerals
ii. Soil its components and Soil profile with various horizons ,
iii. Enlist the various factors affecting Soil formation,
iv. Enlist various types of weathering.

b. Other Activities(Specify):

Identification and Collection of various types of rocks

AE107.2 To understand the major factors affecting the process of weathering. Soil physical properties of different soil types of various locations of India, there colour variations, nutrient content and physical, chemical and biological variation.

Approximate Hours

Item	AppXHrs
CL	5
LI	6
SW	2
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1: To understand the general information about Soil physical and chemical properties of different soil of India **SO2.2** To identify the different colours of soil on basis of abundant nutrient present and climatic condition of India and world. **SO2.3** To learn the contribution of sand, silt, and clay in different types of soil of India.	1. To determination of bulk density, Particle density and moisture content of a given soil. 2. To estimate the porosity of a given soil. 3. Determination of soil texture by feel and Bouycous hydrometer method	**Unit-2 Soil Physics and Colloidal Chemistry** 2.1 To study of various soil physical properties , soil texture and structure 2.2 To know the different colours of soil due to presence of different nutrients in soil of India. 2.3 To learn the classification of India soil taxonomy. 2.4 To assess the bulk density porosity and particle density of soil. 2.5 To learn about the ion exchange theory and pH dependent charge in soil	i. State wise map of India and its climatic condition.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

i. The various Physical properties of soil
ii. Taxonomic classification and distribution of soil of India

b. Other Activities (Specify):

AE107.3 To interpret the soil-water plant relationship and factors affecting them. Soil/Air, its distribution with respect to soil and earth. Soil temperature, availability of different types of microbes in different temperature.

Approximate Hours

Item	AppXHrs
CL	5
LI	2
SW	3
SL	1
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1 To understand the factors responsible in formation of organic matter in soil , its importance and component **SO3.2** To learn parameters used to assess the quality of irrigation water	1. Determination of moisture content in soil	**Unit-3 : Soil organic matter** 3.1 Formation and components of organic matter present in soil 3.2 Factors affecting organic matter in soil 3.3 Develop strategies to mitigate adverse effects of soil acidity, salinity, and sodicity 3.4 asses the quality of irrigation water 3.5 Management Strategies for Soil Health	i. parameters used during assessment of quality of irrigation water

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   - Role , importance and components of organic matter in soil
   - Factors responsible in affecting the organic matter formation
   - Enlist the parameter used to measure the quality of irrigated water

b. **Other Activities(Specify):**

AE107.4 To identify various soil cations, anaions, Silicate clay structures, and colloids. To be able to classify the different microbes present in soil.

Approximate Hours

Item	AppXHrs
Cl	5
LI	10
SW	2
SL	1
Total	22

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 To learn the classification and criteria of essentiality of essential plant nutrients **SO4.2**. To understand the function and deficiency symptoms of various nutrients **SO4.3** To recollect the **c**lassification of fertilizers	1. Determination of pH, 2. Determination of soil Ec. 3. To know the available of N,P,K in soil 4. To know the available secondary nutrient content in soil. 5. To know the available micro nutrient content in soil	**Unit-4: Essential plants nutrients** 4.1. Explore the vital role of essential nutrients such as nitrogen, phosphorus, potassium, and micronutrients in plant growth and development 4.2 Classification, availability, functions and deficiency of essential plant nutrients in soil 4.3 Classification of different types of manure and fertilizer 4.4 Soil-Plant Nutrient Dynamics 4.5 Diagnosis and Correction of Nutrient Deficiencies	i. To study the Periodic table in detail

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Enlist the functions and deficiency symptoms of essential plant nutrients

ii. Enlist the classification, properties and manufacturing process of various fertilizers

d. Other Activities (Specify):

AE107.5 The course aims to equip participants with a comprehensive understanding of utilizing saline and sodic water for crop production, emphasizing strategies to mitigate adverse effects on soil and plants.

Approximate Hours

Item	AppXHrs
Cl	4
LI	2
SW	2
SL	1
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 To know the use of sodic or saline water in crop production in maintaining the soil fertility and health. **SO5.2**To know the use of sodic or saline soil in crop production in maintaining the soil fertility and health. **SO5.3***Reclamation of saline soil and water* **SO5.4** Role of liquid fertilizers and their solubility and compatibility	1. Determination of gypsum requirement of sodic soil	**Unit5: Reclamation of sodic soil and water** 5.1 To learn about reclamation of sodic soil/water 5.2 To learn about reclamation of salaine soil/water 5.3 Application of gypsum in soil with NV 5.4 Use of liquid fertilizers and their solubility	1.List of various liquid fertilizers available in market.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
- Enlist the various parameters used in reclamation of salaine and sodic soil
- Enlist the various parameters used in reclamation of salaine and sodic water

b. **Other Activities(Specify):**

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Lab Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
AE107.1 To learn the general introduction of soil, classification, components, rocks, formation and weathering and its profile.	5	4	2	1	12
AE107.2 To understand the major factors affecting the process of weathering. Soil physical properties of different soil types of various locations of India, there colour variations, nutrient content and physical, chemical and biological variation.	5	6	2	1	14
AE107.3 To interpret the soil-water plant relationship and factors affecting them. Soil/Air, its distribution with respect to soil and earth. Soil temperature, availability of different types of microbes in different temperature.	5	2	3	1	11
AE107.4 To identify various soil cations, anaions, Silicate clay structures, and colloids. To be able to classify the different microbes present in soil.	5	10	2	1	18
AE107.5 The course aims to equip participants with a comprehensive understanding of utilizing saline and sodic water for crop production, emphasizing strategies to mitigate adverse effects on soil and plants.	4	2	2	1	9
Total Hours	**24**	**24**	**11**	**5**	**64**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Fundamentals of Soil Science**	03	01	01	05
CO-2	**Soil Physics and Colloidal Chemistry**	02	06	02	10
CO-3	**Soil organic matter**	03	07	05	15
CO-4	**Essential plants nutrients**	5	5	05	15
CO-5	**Reclamation of sodic soil and water**	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Principles of Soil Science 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, What'sapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Fundamental of soil science	V.N Sahai.	Kalyani publisher, New Delhi	-
2	Principles of Soil Science	M.M Rai	MacMillon India, L.td. New Delhi	1998
3	Fundamental of soil science	Indian Society of soil Science	IARI, New Delhi	1998
4	The nature and properties of soils	Brady, N.C. and Weil, R.R	Prentice hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi	2002
5	Introductory Soil Science	Das, D.K.	Kalyani publisher, New Delhi	2002

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22SC126

Course Title: Principle of Soil Science

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: To learn the general introduction of soil, classification, components, rocks, formation and weathering and its profile.	1	1	1	2	2	1	2	2	1	1	2	1	2	3	3	2
CO 2: To understand the major factors affecting the process of weathering. Soil physical properties of different soil types of various locations of India, there colour variations, nutrient content and physical, chemical and biological variation..	1	1	1	2	3	2	3	1	2	1	2	1	2	3	2	2
CO3: To interpret the soil-water plant relationship and factors affecting them. Soil/Air, its distribution with respect to soil and earth. Soil temperature, availability of different types of microbes in different temperature.	1	2	1	1	3	1	3	2	1	2	3	1	1	2	3	2
CO4: To identify various soil cations, anaions, Silicate clay structures, and colloids. To be able to classify the different microbes present in soil.	2	2	1	2	2	2	3	1	2	2	3	1	3	3	3	2
CO5: The course aims to equip participants with a comprehensive understanding of utilizing saline and sodic water for crop production, emphasizing strategies to mitigate adverse effects on soil and plants.	2	2	1	2	3	2	3	1	1	1	2	1		3	2	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	CO-1: **:** To learn the general introduction of soil, classification, components, rocks, formation and weathering and its profile.	SO1.1 SO1.2 SO1.3 SO1.4	LI 1.1 LI 1.2	**Unit-1.0 Fundamentals of Soil Science** 1.1,1.2,1.3,1.4,1.5	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-2: To understand the major factors affecting the process of weathering. Soil physical properties of different soil types of various locations of India, there colour variations, nutrient content and physical, chemical and biological variation..	SO2.1 SO2.2 SO2.3	LI 2.1 LI 2.2 LI 2.3	**Unit-2 Soil Physics and Colloidal Chemistry** 2.1, 2.2, 2.3, 2.4, 2.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-3: To interpret the soil-water plant relationship and factors affecting them. Soil/Air, its distribution with respect to soil and earth. Soil temperature, availability of different types of microbes in different temperature.	SO3.1 SO3.2	LI 3.1 LI 3.2	**Unit-3** : **Soil organic matter** 3.1, 3.2,3.3,3.4,3.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-4: To identify various soil cations, anaions, Silicate clay structures, and colloids. To be able to classify the different microbes present in soil.	SO4.1 SO4.2 SO4.3	LI 4.1 LI 4.2 LI 4.3 LI4.4 LI4.5	**Unit-4 : Essential plants nutrients** 4.1, 4.2, 4.3, 4.4, 4.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-5 The course aims to equip participants with a comprehensive understanding of utilizing saline and sodic water for crop production, emphasizing strategies to mitigate adverse effects on soil and plants	SO5.1 SO5.2 SO5.3 SO5.4	LI 5.1 LI 5.2 LI 5.3 LI 5.4	**Unit-5** : R**eclamation of sodic soil and water** 5.1, 5.2, 5.3, 5.4	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-I

Course Code:	**22ME127**
Course Title:	Engineering Mechanics
Pre- requisite:	Student should have basic knowledge of mathematics and Physics up to higher secondary level.
Rationale:	As a bridge between theory and application, engineering mechanics is used to formulate new ideas and theories, discover and interpret phenomena and develop experimental and computational tools.

AE108 .1: Understanding of term Mechanics and its classification.

AE108.2: Compute the Centroid, Center of Gravity, moment of inertia of a body.

AE108.3: Understanding the Friction, its types and nature.

AE108.4: Analysing the Simple Framed structure and Trusses.

AE108.5: Understanding the basics of strength of material.

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)	
Engineering Science (ESC)	22ME127	Engineering Mechanics	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ESC	22ME127	**Engineering Mechanics (Theory)**	0	15	15	0	0	30	50	80
		Engineering Mechanics (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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), culminatingin the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AE108.1: **Understanding of term Mechanics and its classification.**

Approximate Hours

Item	AppX Hrs
CL	7
LI	6
SW	2
SL	2
Total	17

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understanding of basic knowledge of term Mechanics. SO1.2 Understanding how objects move when forces are applied to them. Newton's laws lay the foundation for comprehending how forces interact with objects to cause motion.	1.1 Introduction to laboratory, Tools and Equipments 1.2 Problems relating to resultant of; Co-planer force system, collinear force system, concurrent force system, co-planer concurrent force system 1.3 Problems on composition and resolution of forces, moments of a force, couples, transmission of a couple	**Unit-1.0 Introduction to Mechanics** 1.1 Introduction of term mechanics 1.2 classification of mechanics 1.3 static and dynamics 1.4 classification of dynamics 1.5 Force and system of force 1.6 Moment and parallel forces, couples 1.7 General conditions of equilibrium.	**1.** Numerical problem related to classification of mechanics **2.** Numerical problem related to basic laws

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain Newton 2nd law of motion and its application
2. Explain the system of forces

AE108.2: Compute the Centroid, Center of Gravity, moment of inertia of a body.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	6
SW	2
SL	3
Total	17

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Calculate the center of gravity for simple geometric shapes and composite objects. SO2.2Determine the moment of inertia for common shapes (e.g., rods, disks, cylinders) about different axes. And Apply the parallel-axis theorem and perpendicular-axis theorem to simplify moment of inertia calculations. So3.2Develop models or simulations to analyze the dynamic behavior of objects based on their moment of inertia.	**2.1** Problems relating to centroids of composite areas 2.2 Problems on moment of inertia, polar moment of inertia, radius of gyration, polar radius of gyration of composite areas 2.3 Equilibrium of concurrent – co-planer and non concurrent – co-planer force systems	**Unit-2.0 Centre of Gravity and Moment of Inertia** 2.1 Concept of Centroid, Centre of Gravity. 2.2 Difference between Centroid, Centre of Gravity 2.3 Centre of parallel forces, C.G in some simple cases 2.4 Moment of Inertia, Radius of Gyration 2.5 Determination of moment of inertia of simple sections 2.6 Free body diagram and equilibrium of forces	1. Numerical problem related to center of gravity 2. Numerical of MI of T section 3. Numerical of I section.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**

1. Explain the lamis theorem.
2. Derivation of lamis theorem.

AE108.3: Understanding the Friction, its types and nature.

Approximate Hours

Item	AppX Hrs
CL	6
LI	6
SW	1
SL	2
Total	15

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1Explain the causes and effects of friction in mechanical systems and Describe the difference between static and kinetic friction and their respective coefficients So3.2. Solve engineering problems involving frictional forces in inclined planes, pulleys, and other systems. So3.3Analyze the role of friction in limiting motion and causing energy losses in mechanical systems.	3.1 Problems involving frictional forces 3.2 To find the coefficient of friction 3.3 Problems on critical angle	**Unit-3.0 Friction** 3.1Introduction to friction 3.2 Types and nature 3.3 critical angle of friction 3.4 friction on horizontal planes 3.5 frictions on inclined planes 3.6 Rolling friction.	1. Explanation of Limiting friction 2. Numericals on Rolling friction

SW-3 Suggested Sessional Work (SW):

a. Assignments:

I. Explain the importance of friction.

AE108 .4: Analysing the Simple Framed structure and Trusses.

Approximate Hours

Item	AppX Hrs
CL	5
LI	6
SW	2
SL	2
Total	15

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Design truss structures to meet specific engineering requirements (e.g., load-bearing capacity, cost-effectiveness). So4.2Develop models or simulations to predict the behavior of truss systems under different scenarios. Innovate new truss configurations or design approaches for improved structural performance.	4.1 Analysis of simple trusses by method of joints 4.2 Analysis of simple trusses by method of sections 4.3 Analysis of simple trusses by graphical method	Unit-4.0 **Frames and Trusses** 4.1 Introduction to simple frame and truss 4.2 Analysis of simple framed structures using methods of joints 4.3 Analysis of simple framed structures methods of sections 4.4 Analysis of simple framed structures graphical method. 4.5 Numericals	1. Numerical problem of support reaction 2. Numerical problem of truss analysis by joint method.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Classify Beams and Load acting on it.
   2. Explain types of truss.

AE108.5: Understanding the basics of strength of material.

Approximate Hours

Item	AppX Hrs
CL	6
LI	6
SW	1
SL	2
Total	15

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1Analyze stress distributions in beams, columns, and shafts under various loading scenarios. So5.2Evaluate the effects of material properties (e.g., modulus of elasticity, yield strength) on structural integrity. So5.3Interpret stress-strain diagrams and their significance in material behavior.	5.1 Problems relating to simple stresses and strains 5.2 Problems on shear force and bending moment diagrams 5.3 Problems relating to stresses in beams; Problems on torsion of shafts	**Unit-5.0 Strength of Material** 5.1 Simple stresses and types 5.2 Strains and types 5.3 Shear force 5.4 bending moment diagrams 5.5 Stresses in beams 5.6 Torsion. Analysis of plane and complex stresses.	1. Numerical on stresses and strains 2. Numerical on Stresses in beams

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Numerical on bending moment diagrams.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Lab Lecture (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE108.1: Understanding of term Mechanics and its classification.	7	6	2	**2**	17
AE108.2: Compute the Centroid, Center of Gravity, moment of inertia of a body.	6	6	2	**3**	17
AE108.3: Understanding the Friction, its types and nature.	6	6	1	2	15
AE108.4: Analysing the Simple Framed structure and Trusses.	5	6	2	2	15
AE108.5: Understanding the basics of strength of material.	**6**	**6**	**1**	2	15
Total Hours	**30**	**30**	**8**	**11**	79

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**AE108**.1: Understanding of term Mechanics and its classification	03	01	01	05
CO-2	**AE108**.2: Compute the Centroid, Center of Gravity, moment of inertia of a body.	02	06	02	10
CO-3	**AE108**.3: Understanding the Friction, its types and nature.	03	07	05	15
CO-4	**AE108**.4: Analysing the Simple Framed structure and Trusses.	-	10	05	15
CO-5	**AE108**.5: Understanding the basics of strength of material.	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Engineering Graphics & 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:

2. Improved Lecture
3. Tutorial
4. Case Method
5. Group Discussion
6. Role Play
7. Visit to cement plant
8. Demonstration
9. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
10. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mechanics	Dr.R.K bansal	Laxmi Publication(p) ltd.	4rth and 2016
2	Engineering mechanics	R.K Rajpoot	Laxmi Publication(p) ltd.	3rd and 2016
3	Engineering Mechanics: Statics & Dynamics	Russell C. Hibbeler	Pearson	14th Edition, 2015
4	*Engineering Mechanics*	*Timoshenko, and Young*	TMH	5th 2017
5	Training Manual			
6	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech (Agricultural Engineering)

Course Code: 22ME127

Course Title: Engineering Mechanics

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1 Understanding of term Mechanics and its classification	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
CO 2 : Compute the Centroid, Center of Gravity, moment of inertia of a body	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
CO3 Understanding the Friction, its types and nature	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
CO 4: Analysing the Simple Framed structure and Trusses.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
CO 5: Understanding the basics of strength of material.	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CL)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO1 : Understanding of term Mechanics and its classification	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Introduction to Mechanics** 1.1,1.2,1.3,1.4,1.5,1.6,1.7	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2 : Compute the Centroid, Center of Gravity, moment of inertia of a body.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 **Centre of Gravity and Moment of Inertia** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3 Understanding the Friction, its types and nature.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : friction 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: **:** Analysing the Simple Framed structure and Trusses.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : frames and Trusses 4.1, 4.2,4.3,4.4,4.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5 Understanding the basics of strength of material.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5.Strength of materials 5.1,5.2,5.3,5.4,5.5, 5.6	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-II

Course Code:	**22MS221**
Course Title :	**Engineering Mathematics –II**
Pre- requisite:	Objective of this course is to familiarize the prospective engineers with techniques in ordinary and partial differential equations. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
Rationale:	The program aims to develop the tool of power series, complex analysis and Fourier series for learning advanced engineering mathematics

AE 201.1 Understand the importance of ordinary differential equations first order and first degree.

AE 201.2 Understand series solution, solutions of bessels and legenders differential equations.

AE 201.3. Understand and apply the importance of ordinary differential equations in higher order and first degree.

AE 201.4. Understand fourier series and complex analysis.

AE 201.5 Students will create the concept of Partial Differential Equations in higher order.

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)	
Basic Science (BSC)	**22MS221**	Engineering Mathematics -II	3	1	1	1	8	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:

Theory

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/ Home Assign ment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
BSC	22MS221	**Engineering Mathematics -I**	10	15	15	5	5	50	50	100
		Total								**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.

AE 201.1 Understand the importance of ordinary differential equation of first order and first degree.

Approximate Hours

Item	AppX Hrs
CL	13
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand the concept of ordinary differential equation. **SO1.2**Understand the Bernoulli's equation. **SO1.3.** understand cases of differential equation. **SO1.4**Understand the clairauts equations.		**Unit-1.0 Ordinary differential equation -I** 1.1 Introduction exact differential equation 1.2 Bernoulli's differential equations. 1.3 Equation reducible to exact form by integrating factor, 1.4 Equation of first order and first degree. 1.5 Clairauts equation. 1.6 Problems on exact differential equation 1.7 Formation of differential equation 1.8 Finding integrating factor 1.9 Cases of exact differential equation of f(x) only. 1.10 Cases of exact differential equation of f(y) only. 1.11 Cases of exact differential equation of f(x) only. 1.12 Cases of exact differential equation of homogenous form only.	**SL1.1** ordinary differential equation , separable and variable , homogenous differential equation and linear differential equation.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Example on problems on ordinary differential equations.
   2. Example on exact differential equations.
   3. Example on cases of exact differential equations.
   4. Example on problems on exact differential equations.

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

AE 201.2 To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions

Approximate Hours

Item	AppXHrs
CL	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
SO2.1 Understand the concept Solving Second order linear differential with variable coefficients **SO2.2**Understand the Solution by variation of parameters **SO2.3** Understand the Power series solutions **SO2.4** Understand the Legendre's equations and Legendre polynomials.		**Unit –II Bessel and legendere differential equations.** **2.1** Linear differential Equation with constant coefficients **2.2** Complimentary Function and Particular integral **2.3** Solution by Inspection Method **2.4** Solution by change of dependent variable **2.5** Solution by change of Independent variable **2.6** Solution by variation of parameters **2.7** Power series solutions (Frobenius method): **2.8** Series for Ordinary Point **2.9** Legendre's equations and **2.10** Bessel's equation and **2.11** Legenders differential equations	**SL2.1**Examples of Frobenius method

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
    1. Example on Solution by variation of parameters
    2. Example on Power series solutions: Bessel differential equations.
    3. Example on Legendre's equations and
    4. Example on Legendre polynomials
    5. Example on Frobenius method

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

AE 201.3 Demonstrate an understanding of the ordinary differential equation in higher order and first degree.

Approximate Hours

Item	AppXHrs
CL	12
LI	0
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1understand the differentiation of higher order **SO3.2** Understand the complimentary function and particular integrals. **SO3.3** Understand the Cauchy and legendere differential equations. **SO3.4**Understand the simultaneous differential equation of constant coefficients.		**Unit –III Ordinary differential equation -II** 3.1 Differentiation of higher order 3.2 Method of finding complimentary functions 3.3 Method of finding particular integrals 3.4 Method of finding general solutions. 3.5 Cauchy linear equations 3.6 Legendres linear equations 3.7 Simulatenous linear differential equations with constant coefficients. 3.8 Method of variation of parameters.	**SL.1**Examples on cf and pi obtaining general solution of differential equations.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Example on differentiation of higher oder and first degree with constant coefficients.
   2. Example on compliment functions.
   3. Example on particular integrals.
   4. Example on Cauchy and legendre differential equations.

b. Mini Project:
Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):
Quiz, Class Test.

AE 201.4 Define and recognize the method to solve fourier series and complex analysis.

Approximate Hours

Item	AppXHrs
Cl	13
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Understand and Calculation of limits **SO4.2**Understand Fourier series **SO4.3.** understand analytic function. **SO4.4** . understand and apply CR equation and harmonic functions.		**Unit IV Fourier Analysis and Complex Functions** **4.1** Fourier series. **4.2** Eulers formula **4.3** Drichlets conditions. **4.4** Function having arbitrary period. **4.5** Even and odd functions **4.6** Half range series **4.7** Fourier sine series **4.8** Fourier cosine series. **4.9** Cauchy Riemann equation **4.10** Analytic function **4.11** Harmonic functions **4.12** Milne Thomson method	**SL4.1. Fourier series** **SL4.2. CR equation**

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Example on analytic functions.
   2.Example on harmonic functions.
   3.Example on CR equation and milne thomson method.
   4. Example on Fourier series
   5. Example on Even and odd function

b. Mini Project:
Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):
Quiz, Class Test.

AE 201.5 Students will create the concept of a Partial Differential Equations

Approximate Hours

Item	Appx Hrs
CL	11
LI	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 Understand the Solutions of first order linear PDE **SO5.2** Understand the Solution to homogenous and Non-homogenous linear PDE **SO5.3** Understand the First order PDE **SO5.4** Understand PDE of Second order by particular integral method		**Unit V Advanced Partial Differential Equations and Applications** 5.1 Definition of Partial Differential Equations 5.2 First order PDE 5.3 Solutions of first order linear PDE 5.4 Solution to homogenous PDE 5.5 Non-homogenous linear PDE 5.6 PDE of Second order by complimentary function and 5.7 PDE of Second order by particular integral method. 5.8 Lagrange's Linear equation, 5.9 Charpit's method 5.10 Separation of variable method for the solution of heat equations 5.11 wave equations	**SL.1** Problems on PDE

SW-3 Suggested Sessional Work (SW):

a. **Assignments**
   1. Example on linear PDE
   2. Example on Solution to homogenous PDE
   3.Example on Lagrange's Linear equation,
   4.Example on PDE of Second order by complimentary function and5.Example on Charpit's method

b. Mini Project:

Oral presentation, Poster presentation, Power Point Presentation.

c. Other Activities (Specify):

Quiz, Class Test.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
AE201.1 Understand the importance of ordinary differential equations first order and first degree.	13	1	1	15
AE 201.2 To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions	11	1	1	13
AE 201.3 Understand the importance of ordinary differential equations higher order and first degree.	12	1	1	14
AE 201.4. Understand fourier series and complex analysis.	13	1	1	15
AE 201 .5 Students will create the concept of a Partial Differential Equations	11	1	1	14
Total Hours	60	5	5	70

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution					Total Marks
		R	**U**	**A**			
CO-1	Understand the importance of ordinary differential equations first order and first degree.	03	01	01			05
CO-2	To introduce effective mathematical tools for the solutions of ordinary differential equations and solutions with Bessel functions and Legendre functions	02	06	02			10
CO-3	Understand the importance of ordinary differential equations higher order and first degree.	03	07	05			15
CO-4	understand fourier series and complex analysis.	-	10	05			15
CO-5	Students will create the concept of a Partial Differential Equations	03	02		-		05
Total		11	26		13		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
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6 .Seminar
7. Works

Suggested Learning Resources:

a) Books :

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

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22MS221

Course Title: Engineering Mathematics –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
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE 201.1 Understand the importance of ordinary differential equations first order and first degree.	2	2	2	2	2	2	3	1	1	1	1	1	2	3	3	2
AE 201.2 Understand series solution, solutions of Bessel and legenders differential equations.	3	2	3	3	3	2	2	1	2	1	1	1	2	3	2	2
AE 201.3. Understand and apply the importance of ordinary differential equations in higher order and first degree	3	3	2	2	2	2	2	1	1	2	1	1	1	2	3	2
AE 201.4. Understand Fourier series and complex analysis.	3	3	3	3	2	2	2	1	2	2	1	1	3	3	3	2
AE 201.5 Students will create the concept of Partial Differential Equations in higher order	3	3	3	3	2	2	2	1	1	1	1	1		3	2	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	**AE 201.1** Understand the importance of ordinary differential equations first order and first degree.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Ordinary differential equation -I** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 201.2** Understand series solution, solutions of Bessel and legenders differential equations..	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 **Bessel and legendere differential equations.** 2.1, 2.2, 2.3, 2.4, 2.5,2.6,2.7,2.8,2.9,2.10,2.11,2.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 201.3.** Understand and apply the importance of ordinary differential equations in higher order and first degree	SO3.1 SO3.2 SO3.3		Unit-3 : **Ordinary differential equation -II** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10,3.11,3.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 201.4.** Understand Fourier series and complex analysis	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 : **Fourier Analysis and Complex Functions** 4.1, 4.2, 4.3, 4.4, 4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 201.5** Students will create the concept of Partial Differential Equations in higher order	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit-5 : **Advanced Partial Differential Equations and Applications** 5.1, 5.2, 5.3, 5.4, 5.5,5.6,5.7,5.8,5.9,5.10,5.11,5.12	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-II

Course Code	22EV222
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

AE202.1: To overview of environment science and impact of technology on environment and ecosystem also.

AE202.2: To explain about different natural resources such as water resources, forest resources and Energy resources.

AE202.3: To acquired the knowledge of different types of pollution.

AE202.4: To explain about Current environmental global issues

AE202.5: To explain about Definition, concept and types of disaster management, as well as Role of NGOs

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 (CI+LI+SW+SL)	
Basic Science (BSC)	**22EV222**	Environmental Sciences & Disaster Management	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
BSC	**22AE627**	**Environmental Sciences & Disaster Management Theory**	0	15	15	0	0	30	50	80
		Environmental Sciences & Disaster Management (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE202.1 To overview of environment science and impact of technology on environment and ecosystem also

Approximate Hours

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

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.	**Unit 1 Natural Resources and Environmental Sustainability** **1.1.** Scope and Importance of Natural Resources **1.2** Forest Resources use and over utilization **1. 3.** Water Resources use and over utilization, importance in different sector**.** **1.4.** Mineral Resources, Environmental impacts of mining: land degradation, pollution, and habitat destruction. **1.5.** Food Resources , problems and challenges **1.6.** Energy Resources, role and challenges	1. Explore academic articles, reports, and books on topics related to natural resource management and conservation.

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: To analyze the environmental impact of resource exploitation on various natural resources**.**

b. **Mini Project:** To develop a sustainable resource management plan for a specific natural resource.

c. **Other Activities:** To explore the role of individuals in conserving natural resources through self-directed learning.

AE202.2: To explain about different natural resources such as water resources, forest resources and Energy resources.

Approximate Hours

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

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	**Unit 2 Ecosystems and Biodiversity Conservation** 2. Ecosystem Concepts and Structures 2.2 Ecological Dynamics 2.3 Ecosystem Types and Functions 2.4 Biodiversity and Classification 2.5 Value and Levels of Biodiversity 2.6 Threats and Conservation of Biodiversity.	1 To understand the fundamental concepts of ecology and the characteristics of different ecosystems.

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: To analyze and understand the structure, function, and dynamics of a chosen ecosystem.

b. **Mini Project:** To develops a conservation plan for a threatened or degraded ecosystem.

c. **Other Activities:** To observe and document the characteristics and dynamics of a local ecosystem.

AE202.3: To acquired the knowledge of different types of pollution.

Approximate Hours

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand the Environmental pollution - Water pollution SO3.1 Understand the Air pollution:, ambient air quality standards,; soil and noise pollution SO3.1 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	**Unit III Environmental Pollution** 3.1 Types of Pollution: Definitions, Causes, Effects, and Control Measures 3.2 Solid Waste Management 3.3 Individual and Collective Roles in Pollution Prevention 3.4 Social Issues and Environmental Sustainability 3.5 Water Conservation Techniques 3.6 Case Studies and Practical Applications	Knowledge about AQI in Satna MP Knowledge about Control of environmental pollution

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Write detailed reports on the definition, causes, effects, and control measures for each type of pollution (Air, Water, Soil, Marine, Noise, Thermal, Nuclear).

b. **Mini Project:** To design a model urban community that incorporates sustainable practices to manage pollution and waste..

c. **Other Activities:** Group analysis and presentations on notable pollution case studies (e.g., Bhopal Gas Tragedy, Flint Water Crisis, Pacific Garbage Patch).

AE202.4: To explain about Current environmental global issues

Approximate Hours

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

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.	**Unit 4 Environmental ethics:** 4.1 Global Environmental Issues and Solutions 4.2 Environmental Legislation 4.3 Enforcement and Public Awareness 4.4 Human Population and the Environment 4.5 Environment and Human Health 4.6 Role of Information Technology	Knowledge about green house effect. Current environmental global issues

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Research and write detailed reports on the following environmental issues, including causes, effects, and proposed solutions:

b. **Mini Project:** Analyze the effectiveness of key environmental laws and acts in India

c. **Other Activities:** Design and implement a public awareness campaign on one of the following topics: Climate Change and Global Warming, Ozone Layer Depletion& Environmental Laws and Acts

AE202.5: To explain about Definition, concept and types of disaster management, as well as Role of NGOs.

Approximate Hours

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

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. SO5.1 Understand the Forest fires, pollutions. Disaster Management-international Strategy, SO5.1 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 Disaster Management** 5.1 Introduction of natural Disasters 5.2 Types of Natural Disasters 5.3 Effects of Natural Disasters like Socio-economic impacts, Environmental impacts & Human casualties and displacement 5.4 Man-Made Disasters 5.5 Disaster Management Concept & Frame work 5.6 National Disaster Management Framework	Knowledge about disaster management in detail. Knowledge about Role of NGOs. Armed forces in Disaster response.

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Research and report on specific types of natural and man-made disasters, their causes, effects, and mitigation measures.

b. **Mini Project:** Develop a disaster management plan for a hypothetical scenario (e.g., earthquake in a densely populated urban area, chemical spill in an industrial zone).

c. **Other Activities:** Organize awareness campaigns on disaster preparedness and resilience building strategies.

Brief of Hours suggested for the Course Outcome

Course Outcomes	CL	LI	SW	SL	Total hour (Cl+L1+SW+SL)
AE202.1: To overview of environment science and impact of technology on environment and ecosystem also.	6	4	1	1	12
AE202.2: To explain about different natural resources such as water resources, forest resources and Energy resources.	6	4	1	1	12
AE202.3: To acquired the knowledge of different types of pollution	6	4	1	1	12
AE202.4: To explain about Current environmental global issues	6	4	1	1	12
AE202.5: To explain about Definition, concept and types of disaster management, as well as Role of NGOs	6	4	1	1	12
Total Hours	**30**	**20**	**5**	**5**	**60**

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	15	20	15	50

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

The end of semester assessment for Environmental Sciences & Disaster Management (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
- Demonstration
- ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Instagram, WhatsApp, Mobile and other Online sources)
- Brainstorming

Suggested Learning Resources:

(a) 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

Curriculum Development Team

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<u>**Cos, POs and PSOs Mapping**</u>

Course Title: B. Tech. Agricultural Engineering

Course Code: 22EV222

Course Title: Environmental Sciences & Disaster Management

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural
CO1: To overview 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 To explain about different natural resources such as water resources, forest resources and Energy resources.	1	3	2	1	3	3	2	1	2	1	1	1	3	3	3	3
CO3: To 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: To explain about Current environmental global issues	1	1	2	1	3	2	3	1	3	3	1	3	3	3	3	3
CO5: To explain about Definition, concept and 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

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (L I)	Classroom Instruction (CL)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO1: To overview of environment science and impact of technology on environment and ecosystem also..	SO1.1 SO1.2 SO1.3	As Mentioned along with the concern units	Unit-1.0 **Natural Resources and Environmental Sustainability** 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO2: To explain about different natural resources such as water resources, forest resources and Energy resources.	SO2.1 SO2.2 SO2.3		Unit-2 **Ecosystems and Biodiversity Conservation** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3: To acquired the knowledge of different types of pollution	SO3.1 SO3.2 SO3.3		Unit-3 : **Environmental Pollution** 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO4: To explain about Current environmental global issues	SO4.1 SO4.2 SO4.3		Unit-4 : **Environmental ethics** 4.1, 4.2,4.3,4.4,4.5,4.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO5 To explain about Definition, concept and types of disaster management, as well as Role of NGOs	SO5.1 SO5.2 SO5.3		Unit 5. **Disaster Management** 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester- II

Course Code:	**22MT223**
Course Title:	**Entrepreneurship Development and Business Management**
Pre requisite	Students should have advance knowledge of Entrepreneurship Development and Business Management, for developed the ability of Entrepreneurship Development and Business Management Rationale: - Managerial Accounting and Control is the express through the concept and provide the information to Agricultural Economist and professionals in accurate manners. Agricultural Economist or scientist should develop skill in the enterprise analysis and farm business with apply the principle of Managerial Accounting and Control

Course Outcomes:

AE 203.1. Identify the concepts of Entrepreneurship Development and Business Management

AE 203.2. Discriminate the expertise in Business Management and application of Business Management in company Business

AE 203.3. Practice the basics of Business Management through various tools and techniques available.

AE203.4. Estimate the analysis of Entrepreneurship Development and their application in Entrepreneurship Development

AE203.5. Asses the budget and budgetary control methods and application of its knowledge in preparation of budget.

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 CI+LI+SW+SL	
Humanities, Social Science and Management Course **(HSMC)**	**22MT223**	Entrepreneurship Development and Business Management	3	0	1	1	05	03

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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
HSMC	**22MT223**	**Entrepreneurship Development and Business Management**	10	15	15	5	5	50	50	100
		Total								**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.

AE203.1: Identify the concepts of Entrepreneurship Development and Business Management

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**02**
SW	**1**
SL	**1**
Total	**10**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1:Entrepreneurship , management – Management functions – planning- Organizing -Directing – motivation – ordering – leading – supervision- Communication and control – Capital – SO1.2: Financial management – importance of financial statements – SO1.3: balance sheet – profit and loss statement, SO1.4: Analysis of financial statements – liquidity ratios – leverage ratios, SO1.5: Coverage ratios – turnover ratios – profitability ratios,		**UNIT – I Principles of Entrepreneurship and Financial Management** **1.1** Introduction to Entrepreneurship and Management **1.2.** Management Functions Overview **1.3.** Planning of management **1.4** Organizing resources and structuring the organization and Delegation and coordination **1. 5.** Directing and Leading **1.6** Motivation and Supervision **1.7** Communication and Control 1.**8.** Financial Management and Capital **1.9.** Financial Statements and Analysis**.**	Prepare the assignment on Meaning and definition of Entrepreneurship , management – Management functions – planning- Organizing - Directing – motivation – ordering – leading – supervision- Communication and control – Capital

SW-1 Suggested Sessional Work (SW):

a. **Assignments:** To understand and apply financial management principles by analyzing the financial statements of a small business.
b. **Mini Project:** To create a comprehensive business plan that incorporates key management functions and financial planning.
c. **Other Activities (Specify):** o practice decision-making and management skills in a simulated business environment.

AE203. 2: Discriminate the expertise in Business Management and application of Business Management in company Business

Approximate Hours

Item	Approximate Hours
CI	5
LI	2
SW	1
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1: Agro-based industries – Project – project cycle – Project SO1.2. appraisal and evaluation techniques – undiscounted measures – SO1.3. payback period – proceeds per rupee of outlay, Discounted measures – Net Present Value (NPV) – Benefit-Cost So1.4.Ratio (BCR) – Internal Rate of Return (IRR) – Net benefit investment ratio (N / K ratio) – sensitivity analysis- SO1.5.Importance of agribusiness in Indian economy.		**UNIT – II Agro-Based Industries: Project Management and Economic Evaluation** **2. 1.** Agro-based Industries Overview **2.2.** Project Concept in Agro-based Industries **2.3.** Project Appraisal Techniques **3.1.** Undiscounted Measures **2.4.** Sensitivity Analysis in Project Appraisal **2.5.** Importance of Agribusiness in the Indian Economy **2.6.** Case Study: Agro-based Industry Project **2.7.** Project Evaluation Criteria **2.8.** Risk Assessment and Management in Agro-based Projects **2.9.** Future Trends and Opportunities in Agro-based Industries	Prepare the assignment on Meaning and definition of Agro-based industries – Project – project cycle – Project appraisal and evaluation techniques – undiscounted measures – payback period – proceeds per rupee of outlay, Discounted measures – Net Present Value (NPV)

SW-2 Suggested Sessional Work (SW):

a. **Assignments:** To evaluates and compare investment projects using both discounted and undiscounted measures.
b. **Mini Project:** To develop a comprehensive business plan for a new agro-based venture and conduct a feasibility study.
c. **Other Activities (Specify):** To understand and discuss the significance of agribusiness in the context of the Indian economy.

AE203.3 Practice the basics of Business Management through various tools and techniques available.

Item	Approximate Hours
CI	6
LI	2
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1: International trade-WTO agreements SO1.2: Provisions related to agreements in agricultural and food commodities. Agreements on agriculture (AOA) – SO1.3: Domestic supply, market access, export SO1.4: subsidies agreements on sanitary and phyto-sanitary (SPS) measures, SO1.5: Trade related intellectual property rights (TRIPS).		**UNIT – III International Trade and WTO Agreements: Agricultural and Food Commodities.** **3.1** Introduction to International Trade and WTO **3.2.** WTO Agreements Overview **3.4.** Domestic Support **3.5.** Market Access **3.6.** Export Subsidies **3.7.** Agreements on Sanitary and Phytosanitary (SPS) Measures **3.8.** Trade-Related Intellectual Property Rights (TRIPS) **3.9.** Implications for Agricultural and Food Commodities	Prepare the assignment on Meaning and definition of International trade-WTO agreements – Provisions related to agreements in agricultural and food commodities. Agreements on agriculture (AOA) – Domestic supply, market access

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**. To analyze the provisions of WTO agreements related to agricultural and food commodities.
b. **Mini Project:** To investigate and assess the practical implications of WTO agreements on agricultural and food commodities trade.
c. **Other Activities (Specify):** To explore and discuss the implications of WTO agreements on agricultural and food commodities trade through a panel discussion format.

AE203.4 Estimate the analysis of Entrepreneurship Development and their application in Entrepreneurship Development

Item	Approximate Hours
CI	**6**
LI	**2**
SW	**1**
SL	**1**
Total	**10**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1: Entrepreneurship Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– SO1.2: Entrepreneurial and managerial characteristics-Entrepreneurship development Programmes (EDP)- SO1.3: Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- SO1.4: Globalization and the emerging business entrepreneurial environment-Managing an enterprise: Importance of planning, SO1.5: budgeting, monitoring evaluation and follow-up managing competition.		**UNIT –IV Entrepreneurship Development and Business Management.** **4.1.** Concept of Entrepreneur and Entrepreneurship **4.2.** Assessing Overall Business Environment in the Indian Economy **4.3.** Entrepreneurial and Managerial Characteristics **4.4.** Entrepreneurship Development Programmes (EDP) **4.5.** Generation, Incubation, and Commercialization of Ideas and Innovations **4.6.** Motivation and Entrepreneurship Development **4.7.** Globalization and the Emerging Business Entrepreneurial Environment **4.8.** Managing an Enterprise: Importance of Planning, Budgeting, Monitoring, & Evaluation. **4.9.** Managing Competition	Prepare the assignment on Meaning and definition of Entrepreneurship Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy–Entrepreneurial and managerial characteristics-Entrepreneurship.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:** To assess the entrepreneurial characteristics and business environment in the Indian economy.
b. **Mini Project:** To design and propose an Entrepreneurship Development Program (EDP) for a specific target group.
c. **Other Activities (Specify):** To explore and discuss the impact of globalization on the emerging entrepreneurial environment.

AE203.5: Asses the budget and budgetary control methods and application of its knowledge in preparation of budget.

Item	Approximate Hours
CI	6
LI	2
SW	1
SL	1
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1: Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs- SO1.2: Economic system and its implications for decision making by individual SO1.3: entrepreneurs- Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis- Government schemes and incentives for promotion of entrepreneurship. SO1.4: Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract farming (CF) and joint ventures (JV), SO1.5: public-private partnerships (PPP)- Overview of agricultural engineering industry, characteristics of Indian farm		**UNIT – V Entrepreneurship and Economic Development: Policies, Ethics, and Industry Dynamics** **5.1.** Role of Entrepreneurship Development (ED) in Economic Development **5.2.** Overview of Indian Social and Political Systems and Their Implications for Decision-Making by Entrepreneurs **5.3.** Economic System and Its Implications for Decision-Making by Entrepreneurs. **5.4.** Social Responsibility of Business and Morals/Ethics in Enterprise Management 5.**5.** SWOT Analysis in Entrepreneurship 5.**6.** Government Schemes and Incentives for Promotion of Entrepreneurship. **5.7.** Government Policy on Small and Medium Enterprises (SMEs)/SSIs/MSME Sectors. **5.8.** Venture Capital (VC), Contract Farming (CF), Joint Ventures (JV), Public-Private Partnerships (PPP) 5.**9.** Overview of Agricultural Engineering Industry and Characteristics of Indian Farm Machinery Industry	Prepare the assignment on Meaning and definition of Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs- Economic system

SW-5 Suggested Sessional Work (SW):

a. **Assignments:** To analyze the impact of government policies and economic systems on entrepreneurship and economic development in India.
b. **Mini Project:** To develop a proposal for a PPP initiative in the agricultural engineering industry in India.
c. **Other Activities (Specify):** To explore the importance of ethics and social responsibility in enterprise management.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
CO1. Identify the concepts of Entrepreneurship Development and Business Management .	**09**	**01**	**01**	**11**
CO2. Discriminate the expertise in Business Management and application of Business Management in company Business	**09**	**01**	**01**	**11**
CO3. Practice the basics of Business Management through various tools and techniques available.	**09**	**01**	**01**	**11**
CO4. Estimate the analysis of Entrepreneurship Development and their application in Entrepreneurship Development	**09**	**01**	**01**	**11**
CO5. Asses the budget and budgetary control methods and application of its knowledge in preparation of budget.	**09**	**01**	**01**	**11**
Total Hours	**45**	**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	CO1. Identify the concepts of Entrepreneurship Development and Business Management	02	03	00	05
CO 2	CO2. Discriminate the expertise in Business Management and application of Business Management in company Business	02	05	03	10
CO 3	CO3. Practice the basics of Business Management through various tools and techniques available.	00	08	07	15
CO 4	CO4. Estimate the analysis of Entrepreneurship Development and their application in Entrepreneurship Development	02	05	08	15
CO 5	CO5. Asses the budget and budgetary control methods and application of its knowledge in preparation of budget.	00	03	02	05
	Total	06	24	20	50

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

The end of semester assessment for Entrepreneurship Development and Business 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Management of the Farm Business.	Prentice Hall Inc., New Jersey.	Harsh, S.B., Conner, U.J. and Schwab, G.D.	1981
2	Introduction to Agribusiness.	Omri Rawlins, N.	Prentice Hall Inc., New Jersey	1980.
3	Entrepreneurship.	Thomas W Zimmer and Norman M Scarborough	Prentice-Hall, New Jersey.	1996.
4	Entrepreneurship Strategies and Resources.	Mark J Dollinger.	Prentice-Hall, Upper Saddal Rover, New Jersey.	1999.
5	Entrepreneurial Development	Chand and Co. New Delhi.	Text & Cases.	1999.

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22CE125

Course Title: Entrepreneurship Development and Business Management

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE 203.1. Identify the concepts of Entrepreneurship Development and Business Management	1	1	3	2	3	2	3	2	2	1	3	2	2	3	3	3
AE 203.2. Discriminate the expertise in Business Management and application of Business Management in company Business	1	1	2	3	1	2	3	2	1	1	2	2	3	2	2	1
AE 203.3. Practice the basics of Business Management through various tools and techniques available.	3	2	1	1	1	2	3	2	1	2	1	2	1	1	3	2
AE202.4. Estimate the analysis of Entrepreneurship Development and their application in Entrepreneurship Development data, contour lines, and elevation data.	3	2	1	2	3	2	3	2	2	1	2	3	3	3	3	2
AE202.5. Asses the budget and budgetary control methods and application of its knowledge in preparation of budget	3	3	3	2	1	2	3	2	1	1	2	2	3	3	1	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:** Identify the concepts of Entrepreneurship Development and Business Management	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 **Principles of Entrepreneurship and Financial Management** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 2 :** . Discriminate the expertise in Business Management and application of Business Management in company Business	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 **Agro-Based Industries: Project Management and Economic Evaluation** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8,2.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 3** : Practice the basics of Business Management through various tools and techniques available	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : **International Trade and WTO Agreements: Agricultural and Food Commodities.** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 4**: Estimate the analysis of Entrepreneurship Development and their application in Entrepreneurship Development data, contour lines, and elevation data.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : **Entrepreneurship Development and Business Management.** 4.1, 4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 5:** Asses the budget and budgetary control methods and application of its knowledge in preparation of budget instruments.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: **Entrepreneurship and Economic Development: Policies, Ethics, and Industry Dynamics**. 5.1,5.2,5.3,5.4,5.5,5.6,5.7,8.8,5.9	

AKS UNIVERSITY, SATNA
Faculty of Agriculture Science and Technology
Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-II

Course Code:	**22CE 224**
Course Title :	**Fluid Mechanics and Open Channel Hydraulics**
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 are 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:

AE204.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).

AE204.2: Analyze fluid motion using Lagrangian / Eulerian methods, study flow lines and particle acceleration.

AE204.3: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena

AE204.4: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.

AE204.5: Apply dimensional analysis and similitude.

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(CI+LI+ SW+SL)	
ESC	22CE224	Fluid Mechanics and open channel Hydraulic	3	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
ESC	22CE224	**Fluid Mechanics and open channel Hydraulic (Theory)**	0	15	15	0	0	30	50	80
		Fluid Mechanics and open channel Hydraulic (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE204.1 Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).

Approximate Hours

Item	AppX Hrs
Cl	7
LI	4
SW	2
SL	2
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand fluid characteristics like density, viscosity, and surface tension. SO1.2 Master pressure laws, buoyancy, and equilibrium in liquids. SO1.3 Apply fluid knowledge to solve real-world engineering challenges. SO1.4 Develop problem-solving skills in fluid statics scenarios. SO1.5 Use fluid principles for efficient system design across industries.	1.1 Determination of Metacentric Height of Flat bottomed pantoon. 1.2 Study of Pressure Gauge	1.1 Introduction to fluid mechanics and Properties of fluid: Mass density, Weight density. Specific volume, Specific gravity, Viscosity, Surface tension. 1.2 Numerical on properties of fluid. 1.3 Capillarity, Vapour pressure, Compressibility and bulk modulus. 1.4 Fluid statics: Pressure, Pascal's law and Hydrostatic law, 1.5Pressure measurement 1.6Hydrostatic force on submerged plane 1.7Buoyancy and Floatation, Liquid in relative equilibrium.	1. Solve a set of practice problems related to hydrostatic law to reinforce your problem solving skills. 2. Explore Online simulations or Virtual labs related to Fluid Properties, Buoyancy and Floatation.

SW-1 Suggested Sessional Work (SW):

a. Assignments :

i. Explore and differentiate between Newtonian and non-Newtonian fluids. Provide real-world examples of each type and explain how their behavior diverges from conventional Newtonian fluid dynamics.

ii. Discuss the concept of pressure measurement in fluid systems. Explain at least three different methods of measuring fluid pressure and compare their advantages and limitations.

AE 204.2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	6
SW	2
SL	3
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand Lagrangian/Eulerian approaches, various flow types, and characteristics of flow lines. **SO2.2** Grasp continuity equations, fluid particle motion, accelerations, rotational flow, vorticity, and circulation. **SO2.3** Apply knowledge to create and analyze flow nets, understanding their utility in fluid systems. **SO2.4** Explore vortex dynamics and its significance in fluid systems.	2.1 Determination of performance characteristics of centrifugal pump. 2.2 Determination of performance characteristics of Pelton wheel. 2.3 Study of different types of fluid flows	2.1Fluid Kinematics: Description of fluid motion, Langragian and Eulerian approach, Type of fluid flow, 2.2 Type of flow lines 2.3 Continuity equation 2.4 Acceleration of a fluid particle 2.5 Rotational flow, Rotation Vorticity, Circulation 2.6 Stream and potential function, Flow net, Its characteristics and utilities and Vortex motion.	1. Watch YouTube videos on langragian and eulerian approach 2. Draw Stream Line pattern for various flows.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

i) Explain the differences between the Langragian and Eulerian approaches in describing fluid motion. Provide examples to illustrate situations where each approach is more applicable and why.

ii) Define laminar, turbulent, and transitional flow. Compare and contrast these types of flow, highlighting their characteristics and the factors influencing their occurrence. Provide real-world examples for each type of flow.

AE204.3: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	8
SW	1
SL	2
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3:1 Understanding flow transitions from Reynold's experiment to viscous fluid behavior in pipes. SO3:2 Exploring shear stress and pressure gradient in Couette flow for parallel plate systems SO3:3 Grasping energy loss in pipes, hydraulic gradient, and optimizing pipe configurations. SO3:4 Applying equivalent pipe power transmission and managing water hammer effects in pipes.	3.1 To determine the minor head loss coefficient of different pipe fittings. 3.2 Determine the Renyold's no in different flow conditions. 3.3 Determination of Coefficient of Discharge of Rectangular and Triangular Notch. 3.4 Study of fluid flow through pipes	3.1 Laminar & Turbulent flow: Reynold's experiment 3.2 F low of viscous fluids in circular pipe 3.3 Shear stress & velocity distribution for turbulent. 3.4 Shear stress and pressure gradient between two parallel plates 3.5 Flow through pipes: Loss of energy in pipes 3.6Hydraulic gradient and total energy line and Pipe in series and parallel.	1. Explore the phenomenon of cavitation in fluid flow. Investigate the condition under which cavitation occurs, its effects on pipes and equipment, and methods to prevent or mitigate cavitation. 2. Explore the principles of Syphon Systems in Fluid Transport.

SW-3 Suggested Sessional Work(SW):

a. Assignments:

i) Describe the characteristics of turbulent flow concerning shear stress and velocity distribution in a pipe. Compare and contrast these characteristics with those of laminar flow. Provide explanations supported by equations and graphical representations

.

AE 204.4: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena

Approximate Hours

Item	AppX Hrs
Item	AppX Hrs
Cl	5
LI	8
SW	2
SL	2

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**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. 4.3 To determine hydraulic Coefficients Cd, Cv and Cc of an Orifice. 4.4 Study of Reynolds transport theorem	4.1 Fluid dynamics: Euler's Equation 4.2 Bernoulli's equation and its practical application, 4.3 Venturimeter and Orifice meter 4.4Nozzle and Pitot tube 4.5 Impulse momentum equation 4.6 Reynold's transport theorem .	1. Choose a real life example and demonstrate how Bernoulli's Equation can be applied to analyze the fluid mechanics. 2. Choose a fluid flow scenario and apply the Renyold's Transport Theorem to analyze the changes in mass, Momentum and energy with in the system.

SW-4 Suggested Sessional Work SW):

A. Assignments:

i) Describe the characteristics of turbulent flow concerning shear stress and velocity distribution in a pipe. Compare and contrast these characteristics with those of laminar flow. Provide explanations supported by equations and graphical representations

AE 204.5: Apply dimensional analysis and simplitude.
.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	4
SW	1
SL	2
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Use Darcy-Weisbach and Moody's diagram for internal flow friction calculations. SO5.2 Differentiate laminar and turbulent layers, explore growth, and solutions for momentum layers. SO5.3 Solve equations, grasp momentum principles, and separation factors. SO5.4 Use Rayleigh's and Buckingham's methods for fluid behavior using dimensionless numbers. SO5.5 Explain Reynold's, Fraude's, Euler's, Weber's, and Mach's laws in predicting varied fluid behaviors.	5.1 Determination of Friction Factor 'f' for G.I pipes. 5.2 Study of Boundary Layer theory	. 5.1 Dimensional analysis: Methods of dimensional analysis, Rayleigh's method 5.2 Buckingham's theorem, Limitations 5.93Model analysis, Dimensionless number and their significance 5.4 Model laws, Reynolds model law, 5.5Fraude's model law, Euler's model law, Weber's model law, Mach's Model law.	1. Investigate methods to control and prevent boundary layer separation. 2. Investigate the limitations of dimensional analysis. 3. Choose a specific flow scenario and use Moody's Diagram to determine the friction Factor.

SW-5 Suggested Sessional Work (SW):

a. Assignments:
i) Discuss real-world applications where understanding friction factors and boundary layer theory is crucial.

b. Mini Project:
i. Construct a setup simulating flow over a flat plate using a wind tunnel or a controlled airflow system.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE204.1: Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	7	4	2	2	17
AE204.2: Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	6	6	2	3	17
AE204.3: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	6	8	1	2	15
AE204.4: Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations. .	5	8	2	2	15
AE204.5: .dimensional analysis methods and model laws in fluid dynamics.	6	4	1	2	15
Total Hours	30	30	8	11	79

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 Process calculation 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition Year
1	Fluid Mechanics & Hydraulic Machines	S.S. Rattan	Khanna Book Publishing	2019
2	Introduction to Fluid Mechanics,	P.J. Pritchard, A.T. McDonald and R.W. Fox	Wiley India	2012
3	“Fluid Mechanics	F.M. White	Tata McGraw Hill	2011
4	“Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty	Tata McGraw Hill	2017
5	A Textbook of Fluid Mechanics and Hydraulic Machines	R. K. Bansal	Laxmi Publication	2005
6	Mechanics of Fluids	Shames	McGraw Hill Book Co. New Delhi	1988

Curriculum Development Team

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<u>**Cos, POs and PSOs Mapping**</u>

Course Title: B. Tech (Agricultural Engineering)

Course Code: 22CE 224

Course Title: Fluid Mechanics and Open Channel Hydraulics

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE204.1: 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
AE204.2: Analyze fluid motion using Lagrangian / Eulerian methods, study flow lines and particle acceleration.	3	2	2	1	1	2	1	2	2	1	2	3	2	2	2	1
AE204.3 Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena.	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
AE204.4: : Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
AE204.5: dimensional analysis methods and model laws in fluid dynamics.	2	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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	**AE 204.1** Grasp fluid properties (density, viscosity, surface tension) and understand static principles (pressure laws, buoyancy).	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1 1.2	Unit-1.0 Properties of Fluid and Fluid Statics 1.1,1.2,1.3,1.4,1.5,1.6,1.7	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 204.2** Analyze fluid motion using Lagrangian/Eulerian methods, study flow lines and particle acceleration.	SO2.1 SO2.2 SO2.3 SO2.4	2.1 2.2 2.3	Unit-2 Fluid Kinematics 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 204.3**: Differentiate between laminar/turbulent flow, study pipe flow, energy losses, configurations, and pipe phenomena..	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	3.1 3.2 3.3 3.4	Unit-3 : Fluid Dynamics 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 204.4:** Apply Euler's/Bernoulli's equations, understand Venturimeter, Orifice meter, and implications of momentum equations.	SO4.1 SO4.2 SO4.3 SO4.4	4.1 4.2 4.3 4.4	Unit-4 :laminar and turbulent flow and flow through pipes 4.1, 4.2,4.3,4.4,4.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE 204.5**: dimensional analysis methods and model laws in fluid dynamics.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	5.1 5.2	Unit 5: Internal flows and dimensional analysis 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-II

Course Code: **22ME225**

Course Title: **Theory of machines**

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: The theory helps engineers understand how different types of machines operate, from simple mechanisms to complex systems. It provides the foundational principles for designing machines that are efficient, safe, and reliable. It provides a framework for solving engineering problems related to the design and operation of machines.

Course Outcomes:

AE205 .1: Students analyze complex mechanisms using graphical methods to determine velocity and acceleration, optimizing mechanical systems in practical applications."

AE205.2: Understanding gear types, laws of gearing, sliding velocity, involute and cycloidal profiles, spur gear characteristics, interference, and helical gear basics.

AE205.3: Analyzing velocity ratio via tabular method, turning moment diagrams, fluctuation coefficients, flywheel dynamics, belt drives, materials, sizing, and power transmission considerations."

AE205.4: Exploring chain drives, dry friction laws, pivot and collar friction, disc and cone clutches, rolling friction, anti-friction bearings, and governor types.

AE205.5: Understanding friction effects, force curve control, governor characteristics (sensitivity, stability, hunting, iso-chronism, power, and effort), static and dynamic balancing.

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)	
ESC	22ME225	Theory of machines	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/ Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
ESC	22ME225	Theory of machines	10	15	15	5	5	50	50	100
		Total								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.

AE205.1: Students analyze complex mechanisms using graphical methods to determine velocity and acceleration, optimizing mechanical systems in practical applications.

Approximate Hours

Item	AppXHrs
CL	06
LI	0
SW	03
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Identify elements, links, and pairs in mechanical systems accurately. SO1.2 Classify pairs and mechanisms based on relative motion and contact. SO1.3 Understand four-bar and slider-crank chains, and their inversions. SO1.4 Apply graphical methods to determine velocity and acceleration effectively. SO1.5 Analyze motion using instantaneous centers for precise kinematic solutions.		**Unit-1.0 Simple Mechanism and Kinematic analysis** 1.1 Elements, links, pairs, kinematics chain, and mechanisms. 1.2 Classification of pairs and mechanisms. Lower and higher pairs. 1.3 Four bar chain, slider crank chain and their inversions. 1.4 Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. 1.5 Instantaneous centers. 1.6 Numerical problems	1.1 Analysis of Inversion of single slider crank chain mechanism. 1.2 Numerical practice of DOF

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Numerical problem of Velocity Analysis by Relative velocity Approach
ii. Numerical problem of Acceleration Analysis.
iii. Classification of Kinematic Pair

AE205.2: Understanding gear types, laws of gearing, sliding velocity, involute and cycloidal profiles, spur gear Characteristics, interference, and helical gear basics.

Approximate Hours

Item	AppX Hrs
CL	06
LI	00
SW	03
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Identify gear types, including spur, helical, bevel, spiral, and worm. SO2.2 Explain the law of gearing and its applications in mechanisms. SO2.3 Calculate sliding velocity between gear teeth using appropriate formulas. SO2.4 Differentiate between involute and cycloidal profiles for gear teeth. SO2.5 Recognize nomenclature, interference, and undercutting issues in spur gears.		**Unit-2.0GEAR AND GEAR TRAIN** 2.1 Types of gears. 2.2 Law of gearing, velocity of sliding between two teeth in mesh. 2.3 Involute and cycloidal profile for gear teeth. 2.4 Spur gear, nomenclature, interference and undercutting. 2.5 Simple, compound, reverted, and epicyclic trains. 2.6 Numerical problem solving	2.1 Nomenclature of gear 2.2 difference between involute and cycloidal teeth profile.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Classify Gear
2. Numerical problem of Involutes gear analysis
3. Numerical problem of Epicyclic gear train.

AE205.3: Analyzing velocity ratio via tabular method, turning moment diagrams, fluctuation coefficients, flywheel dynamics, belt drives, materials, sizing, and power transmission considerations.

Approximate Hours

Item	AppX Hrs
CL	06
LI	00
SW	03
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Calculate velocity ratios via tabular methods for mechanical systems SO3.2 Construct turning moment diagrams and analyze fluctuation coefficients. SO3.3 Evaluate flywheel weight and its significance in energy storage. SO3.4 Examine belt drives, materials, and their applications in machinery. SO3.5 Determine belt length, size, and consider effects like centrifugal tension.		**Unit-3.0** 3.1 Determining velocity ratio by tabular method. Turning moment diagrams 3.2 Coefficient of fluctuation of speed and energy, weight of flywheel, 3.3 Flywheel applications. 3.4 Belt drives, types of drives, belt materials. 3.5 Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. 3.6 Effect of centrifugal tension, creep and slip on power transmission	3.1. Numerical problem related to porter governor 3.2. Numerical problem related to gyros couple

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

1. Discuss the advantages and disadvantages of belt drives in comparison to chain and gear drives. Provide real-world examples where belt drives are commonly used.

AE205.4: Exploring chain drives, dry friction laws, pivot and collar friction, disc and cone clutches, rolling friction, anti-friction bearings, and governor types.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	00
SW	02
SL	01
Total	09

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Describe types of friction and the laws governing dry friction. SO4.2 Analyze friction in pivots and collars in mechanical systems. SO4.3 Explain the operation and applications of single disc, multiple disc, and cone clutches. SO4.4 Discuss the concept of rolling friction and the role of anti-friction bearings. SO4.5 Compare the construction and function of Watt, Porter, and Proell governors in mechanical systems.		**Unit-4.0 Mechanical Power Transmission and Control Systems"** 4.1 Chain drives. 4.2 Types of friction, laws of dry friction. 4.3 Friction of pivots and collars. 4.4 Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings. 4.5 Types of governors. 4.6 Constructional details and analysis of Watt, Porter, Proell governors.	1. Compare and contrast chain drive with other types of mechanical power transmission systems.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Derive the expression for height of Porter governor
2. Derive the expression for stiffness of spring in Hartnell governor
3. Derive the expression for gyroscopic couple

AE205.5: Understanding friction effects, force curve control, governor characteristics (sensitivity, stability, hunting, iso-chronism, power, and effort), static and dynamic balancing

Approximate Hours

Item	AppX Hrs
CL	06
LI	00
SW	02
SL	02
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Analyze the impact of friction on controlling force curves in mechanical systems. SO5.2 Evaluate the sensitiveness, stability, hunting, and iso-chronism of governors. SO5.3 Explain the relationship between power, effort, and the function of a governor. SO5.4 Differentiate between static and dynamic balancing techniques. SO5.5 Apply methods for balancing rotating masses in both single and multiple planes.		**Unit-5.0 Static and dynamic balancing** 5.1 Effect of friction, controlling force curves. 5.2 Sensitiveness, stability, hunting, iso-chronism, 5.3 power and effort of a governor. 5.4 Static and dynamic balancing. 5.5 Balancing of rotating masses in one and different planes. 5.6 Numerical Solving	5.1 Numerical Problem on static balancing 5.2 Numerical Problem on balancing when masses are rotating in different plane

SW-5Suggested Sessional Work (SW):

a. **Assignments:**
   1. Explain the concept of balancing in reciprocating engine
   2. Explain the balancing of in line 4 stroke engine.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Lab Lecture (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+LI+SW+SL)
AE205.1: Students analyze complex mechanisms using graphical methods to determine velocity and acceleration, optimizing mechanical systems in practical applications.	06	00	03	02	11
AE205.2: Understanding gear types, laws of gearing, sliding velocity, involute and cycloidal profiles, spur gear characteristics, interference, and helical gear basics.	06	00	03	02	11
AE205.3: Analyzing velocity ratio via tabular method, turning moment diagrams, fluctuation coefficients, flywheel dynamics, belt drives, materials, sizing, and power transmission considerations**.**	06	00	03	02	11
AE205.4: Exploring chain drives, dry friction laws, pivot and collar friction, disc and cone clutches, rolling friction, anti-friction bearings, and governor types.	06	00	02	01	09
AE205.5: Understanding friction effects, force curve control, governor characteristics (sensitivity, stability, hunting, iso-chronism, power, and effort), static and dynamic balancing	06	00	02	02	10
Total Hours	30	00	13	09	52

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Simple Mechanism and Kinematic analysis	03	01	01	05
CO-2	Gear and gear train	02	06	02	10
CO-3	"Power Transmission and Motion Control in Mechanical Systems"	03	07	05	15
CO-4	"Mechanical Power Transmission and Control Systems"	-	10	05	15
CO-5	Static and dynamic balancing	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Theory of machine will be held with written examination of 50marks

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:

3. Improved Lecture
4. Tutorial
5. Case Method
6. Group Discussion
7. Role lay
8. Demonstration
9. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT, Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
10. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Theory of Machines	Ballaney P L	Khanna	2003
2	Theory of Machines	Rattan S S	TMH	3rd and 2009
3	Theory of Machines	R S Khurmi	S. Chand Publication.	2022
4	Theory of Machines	Sadhu Singh	TMH	3rd and 2011
6	Theory of Machines	A GHOSH	East west	2015
7	Training Manual			
8	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna.			

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech Agriculture Engineering

Course Code: 22ME225

Course Title: Theory of machine

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE205.1: "Students analyze complex mechanisms using graphical methods to determine velocity and acceleration, optimizing mechanical systems in practical applications."	1	1	2	2	2	2	3	1	2	2	1	2	2	2	1	-
AE205.2: Understanding gear types, laws of gearing, sliding velocity, involute and cycloidal profiles, spur gear characteristics, interference, and helical gear basics.	1	2	2	2	1	2	2	1	1	1	2	3	2	2	2	1
AE205.3: Analyzing velocity ratio via tabular method, turning moment diagrams, fluctuation coefficients, flywheel dynamics, belt drives, materials, sizing, and power transmission considerations."	2	2	1	1	2	2	2	1	1	2	1	2	2	1	2	2
AE205.4: Exploring chain drives, dry friction laws, pivot and collar friction, disc and cone clutches, rolling friction, anti-friction bearings, and governor types.	3	2	2	-	3	1	3	1	2	1	-	2	3	3	3	2
AE205.5: Understanding friction effects, force curve control, governor characteristics (sensitivity, stability, hunting, iso-chronism, power, and effort), static and dynamic balancing	1	2	2	-	1	1	3	1	1	1	2	2	3	3	1	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)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4,5	AE205.1: "Students analyze complex mechanisms using graphical methods to determine velocity and acceleration, optimizing mechanical systems in practical applications."	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1.0 Simple Mechanism and Kinematic analysis** 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	AE205.2: Understanding gear types, laws of gearing, sliding velocity, involute and cycloidal profiles, spur gear characteristics, interference, and helical gear basics.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2.0 GEAR AND GEAR TRAIN** 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	AE205.3: Analyzing velocity ratio via tabular method, turning moment diagrams, fluctuation coefficients, flywheel dynamics, belt drives, materials, sizing, and power transmission considerations."	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3.0 Power Transmission and Motion Control in Mechanical Systems** 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	AE205.4: Exploring chain drives, dry friction laws, pivot and collar friction, disc and cone clutches, rolling friction, anti-friction bearings, and governor types.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**unit-4.0 Mechanical Power Transmission and Control Systems** 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	AE205.5: Understanding friction effects, force curve control, governor characteristics (sensitivity, stability, hunting, iso-chronism, power, and effort), static and dynamic balancing	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit-5.0 Static and dynamic balancing** 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-II

Course Code:	**22ME226**
Course Title:	**Workshop Technology and Practice**
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:

AE 206.1: Develop fundamental skills such as measuring, cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.

AE 206.2: 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.

AE 206.3: Comprehensive understanding and proficiency in casting processes, center lathe construction, accessories, shapers, work holding devices, tools, and operations.

AE 206.4: Mastery in identifying and operating pillar and radial drilling machines, understanding work and tool holding devices, performing main operations, and analyzing drill types.

AE 206.5: Proficiency in understanding and utilizing column & knee type universal milling machines, plain milling cutters, and performing essential milling operations effectively.

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)	
Engineering ScienceCore (ESC)	22ME226	Workshop Technology and Practice	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
ESC	**22ME226**	**Workshop Technology and Practice (Theory)**	0	15	15	0	0	30	50	80
		Workshop Technology and Practice (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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), culminatingin the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AE 206.1: Develop fundamental skills such as measuring, cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.

Approximate Hours

Item	AppX Hrs
CL	03
LI	12
SW	1
SL	2
Total	18

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 proficiency in measuring cutting and assembling wood. **SO1.2** acquire knowledge in using various tools like saws, drills and planes **SO1.3** understand joinery techniques, wood finishing and safety practices	1.1 Safety instructions for using various carpentry tools. 1.2 Carpentry tools introduction. 1.3 Instructions for using proper tools in the correct way 1.4 Drawing of a simple workpiece for preparation of common carpentry joinery work. 1.5 Demonstration of different inspection , checking and measuring methods used for proper carpentry work. 1.6 Production of any one type of joints listed below- Dovetail Joint/Corner Joint/Mortise and Tenon Joint etc.	**Unit-1.0 Carpentry Shop.** 1.1 Introduction to various carpentry tools, materials. 1.2 Types of wood and their characteristics 1.3 Processes or operation in wood working.	1. Defects in timber 2. Conversion of Wood

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the different operation performed in wood working

ii. Sketch and describe the different joints made in carpentry shop.

iii. Explain the different types of wood working machines used in modern wood work.

AE 206.2: 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.

Approximate Hours

Item	AppX Hrs
Cl	03
LI	12
SW	1
SL	2
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand different cutting tools like hacksaw, chisels etc. **SO2.2** acquires knowledge of various fitting and assembly techniques. **SO2.3** Performing set up, adjustment of flame and gas pressure, and shutdown procedure for oxyacetylene welding and cutting equipment.	2.1 Safety instructions for using various fitting hand tools. 2.2 Tools Introduction 2.3 Instructions for using proper tools in the correct way 2.4 Drawing of a simple work piece for carrying out different fitting operations. 2.5 Demonstration of different inspection , checking and measuring methods used for proper fitting work. 2.6 Actual performance of a small simple job.	**Unit-2 Smithy and Welding Shop** 2.1 Introduction to Smithy tools and operations 2.2 Introduction to welding, types of welding, Oxyacetylene gas welding, types of flames 2.3 Welding techniques and equipment. Principle of arc welding, equipment and tools	1. Study of TIG and MIG welding process 2. Study of Thermit welding process

SW-2 Suggested Sessional Work (SW):

a. Assignments:
   i. Explain different striking tools with neat sketch
   ii. Explain different types of vices used in fitting shop.

b. Mini Project:
   i. Preparing lap joint using arc welding process.

AE 206.3: Comprehensive understanding and proficiency in casting processes, center lathe construction, accessories, shapers, work holding devices, tools, and operations.

Approximate Hours

Item	AppX Hrs
CL	03
LI	12
SW	1
SL	2
Total	18

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1 The production of cast metal component, quality control measures and adherence to manufacturing standards SO3.2 Analyze the constructional details of a center lathe including bed, headstock, tailstock, and carriage. SO3.3 Identify types, understand construction, operate safely, and execute shaping, slotting, and keyway cutting operations effectively**.**	3.1 Safety instructions for foundry shop, pattern making, mould preparation. 3.2 Foundry tools introduction. 3.3 Instructions for using proper tools in the correct way 3.4 Drawing of a simple work piece for preparation of a pattern. 3.5 Instructions for sand preparation, mould preparation, melting and casting properly in the safe manner. Production of a simple casting.	**Unit-3 : Casting , Lathe and Shaper Machine** 3.1 Casting processes; Classification, constructional details of center lathe 3.2 Main accessories and attachments. Main operations and tools used on center lathes 3.3 Types of shapers, Constructional details of standard shaper. Work holding devices, shaper tools and main operations	1. Types of moulding sand. 2. Types of pattern

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Mechanical properties of engineering materials. Explain advanced manufacturing methods

AE 206.4: Mastery in identifying and operating pillar and radial drilling machines, understanding work and tool holding devices, performing main operations, and analyzing drill types**.**

Approximate Hours

Item	AppX Hrs
CL	03
LI	12
SW	1
SL	2
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Identify types of drilling machines, understand their construction, and distinguish between pillar and radial drilling machines effectively. **SO4.2** Demonstrate knowledge of work and tool holding devices, execute main operations, and comprehend twist drills, angles, sizes, and classification.	4.1 Safety instructions for machine shop. 4.2 Lathe Machine introduction. 4.3 Instructions for using drilling machine in the correct way 4.4 Drawing of a simple work piece in lathe machine. 4.5 Instructions for machining in lathe and milling machine properly in the safe manner. 4.6 Production of a simple machining object.	**Unit-4 : Drilling Machine** 4.1 Types of drilling machines. Constructional details of pillar types and radial drilling machines. 4.2 Work holding and tool holding devices. Main operations. 4.3 Twist drills, drill angles and sizes. Types and classification.	1. Types of drilling tools and threading tools. 2. Various operation performed on drilling machine

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

i. Explain different accessories and attachments in drilling machine

AE 206.5: : Proficiency in understanding and utilizing column & knee type universal milling machines, plain milling cutters, and performing essential milling operations effectively.

Approximate Hours

Item	AppX Hrs
CL	03
LI	12
SW	1
SL	2
Total	18

Session Outcomes (SOs)	LaboratoryInstruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand column and knee milling machine structure, operation principles, and plain milling cutter functions for various machining operations efficiently **SO5.2** Mastery over milling machine basics: column-knee design, plain cutter usage, and essential machining operations for precision manufacturing processes.	5.1 Safety instructions for welding shop. 5.2 Welding tools introduction for Electric Arc Welding process. 5.3 Instructions for using proper tools in the correct way. 5.4 Drawing of a simple welded joint viz. Square butt joint, T joint , Lap joint etc. 5.5 Demonstration of producing a square butt joint using MMAW process. 5.6 Actual production of a welded joint as described above.	**Unit 5: Milling Machine** 5.1 Constructional details and principles of operation of column and knee type universal milling machines 5.2 Plain milling cutter 5.3 Main operations on milling machine	1. Classification of milling machine. 2. Various operation performed on milling machine.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Explain different work holding devices in milling machine.
ii. Advantages and disadvantages of milling machine

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Laboratory Instruction (LI)	Self Learning (SL)	Total hour (CL+SW+SL)
AE 206.1: Develop fundamental skills such as measuring , cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.	3	1	12	2	18
AE 206.2: 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.	3	1	12	2	18
AE 206.3: Comprehensive understanding and proficiency in casting processes, center lathe construction, accessories, shapers, work holding devices, tools, and operations.	3	1	12	2	18
AE 206.4: Mastery in identifying and operating pillar and radial drilling machines, understanding work and tool holding devices, performing main operations, and analyzing drill types.	3	1	12	2	18
AE 206.5: Proficiency in understanding and utilizing column & knee type universal milling machines, plain milling cutters, and performing essential milling operations effectively.	3	1	12	2	18
Total Hours	15	5	60	10	90

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Carpentry shop	04	05	01	10
CO-2	Smithy and Welding Shop	05	04	01	10
CO-3	Casting , Lathe and Shaper Machine	02	05	03	10
CO-4	Drilling Machine	04	04	02	10
CO-5	Milling Machine	05	03	02	10
Total		20	21	09	50

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

The end of semester assessment for Workshop Technology and Practice 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) 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,	4^{th} edition, 1998
5	Lecture note provided by Dept. of Mechanical Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agriculture Engineering
Course Code: 22ME226
Course Title: Workshop Technology and Practice

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 investing actions 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	o make expertise in design and ngineering problem solving pproach in agriculture with roper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	bility to use the research based nnovative knowledge for ustainable development in gricultural Engineering.
CO1: Develop fundamental skills such as measuring, cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.	2	1	2	2	3	2	2	2	2	1	3	2	2	2	1	2
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.	1	1	1	1	3	2	2	2	2	1	2	2	1	2	1	2
CO3 : Comprehensive understanding and proficiency in casting processes, center lathe construction, accessories, shapers, work holding devices, tools, and operations.	2	2	1	1	3	1	2	2	2	1	1	2	1	2	1	1
CO 4: Mastery in identifying and operating pillar and radial drilling machines, understanding work and tool holding devices, performing main operations, and analyzing drill types.	2	2	2	1	3	2	2	2	2	1	2	2	1	2	1	2
CO 5: Proficiency in understanding and utilizing column & knee type universal milling machines, plain milling cutters, and performing essential milling operations effectively.	2	1	1	1	1	3	2	2	2	1	2	2	1	2	1	1

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	CO-1: Develop fundamental skills such as measuring , cutting and joining wood. Gain expertise in handling various carpentry tools and machinery.	SO1.1 SO1.2 SO1.3	1.1 1.2 1.3 1.4 1.5 1.6	Unit-1.0 Carpentry shop 1.1,1.2,1.3	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	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.	SO2.1 SO2.2 SO2.3	2.1 2.2 2.3 2.4 2.5 2.6	Unit-2 Smithy and Welding Shop 2.1, 2.2, 2.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3 : Comprehensive understanding and proficiency in casting processes, center lathe construction, accessories, shapers, work holding devices, tools, and operations.	SO3.1 SO3.2 SO3.3	3.1 3.2 3.3 3.4 3.5 3.6	Unit-3 : Casting , Lathe and Shaper Machine 3.1, 3.2,3.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 4: Mastery in identifying and operating pillar and radial drilling machines, understanding work and tool holding devices, performing main operations, and analyzing drill types..	SO4.1 SO4.2	4.1 4.2 4.3 4.4 4.5 4.6	Unit-4 : Drilling Machine 4.1, 4.2,4.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 5: Proficiency in understanding and utilizing column & knee type universal milling machines, plain milling cutters, and performing essential milling operations effectively.	SO5.1 SO5.2	5.1 5.2 5.3 5.4 5.5 5.6	Unit 5: Milling Machine 5.1,5.2,5.3	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-II

Course Code: 22ME227

Course Title: Strength of Materials

Pre-requisite: Understanding of mechanics, physics, and calculus.

Rationale: Strength of Materials deals with the study of how solid materials withstand various forces and loads. It helps engineers understand the behavior of materials under stress, enabling the design of structures and machines that can withstand expected loads without failure. By analyzing stresses, strains, and deformations, Strength of Materials provides insights into material properties and structural integrity, essential for ensuring safety and reliability in engineering applications.

Course Outcomes:

AE 207.1: Understanding of basic mechanics and material behavior through topics such as stress, strain, direct and shear stress, free body diagrams and Poisson's ratio.

AE 207.2: Understanding elastic constants, their interrelationships, and their impact on volume changes in materials.

AE 207.3: Understanding and applying energy principles to solve stress and strain problems, including gradual and sudden force applications and utilizing Mohr circle for complex stress analysis for stress problems.

AE 207.4: Ability to analyze and predict the slope, deflection, and internal forces in beams using integration methods, moment area theorems, and conjugate beam method.

AE 207.5: To analyze and design structural elements like beams, columns, and connections considering stability and deflection under various loading conditions.

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)	
Engineering Science (ESC)	22ME227	Strength of Materials	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
Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ESC	**22ME227**	**Strength of Materials (Theory)**	0	15	15	0	0	30	50	80
		Strength of Materials (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE207 .1: Understanding of basic mechanics and material behavior through topics such as stress, strain, direct and shear stress, free body diagrams and Poisson's ratio.

Approximate Hours

Item	AppX Hrs
CL	7
LI	6
SW	1
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understanding of simple stress and strain, including the ability to calculate and analyze direct stress and shear strain. **SO1.2** Proficiency in creating and interpreting free body diagrams. **SO1.3** Mastery of the concepts of uniform and non-uniform sections, with the capability to identify and analyze stress and strain. **SO1.4** Competence in calculating and evaluating strain in uniform tapering sections, and applying this knowledge to solve engineering problems related to tapered components. **SO1.5** Comprehensive understanding of lateral strain, Poisson's ratio, and the concept of dimensional changes.	1. To study the tension test on metal specimen (M.S., C.I.). 2. Experiment of tension test on metal specimen (M.S.). 3. Experiment of tension test on metal specimen (C.I.).	**Unit-1.0 Fundamentals of Stress and Strain Analysis** 1.1 Introduction of the subject 1.2 Concept of simple stress, strain, 1.3 direct stress, shear strain, 1.4 free body diagram, concept of uniform and non-uniform sections, 1.5 strain in uniform tapering section, 1.6 Lateral strain, Poisson's ratio 1.7 Change in dimensions of different shapes.	1. Why study of stress and strain is important?

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Practice of numerical problems on stress and strain.

AE 207 .2: Understanding elastic constants, their interrelationships, and their impact on volume changes in materials.

Approximate Hours

Item	AppX Hrs
CL	5
LI	4
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Understand the concept of elastic constants and their significance in material behavior. **SO2.2** Gain knowledge about thermal stresses and their origins in materials subjected to temperature gradients. **SO2.3** Learn how to analyze the mechanical behavior of composite sections under various loading conditions. **SO2.4** Apply mathematical relationships between elastic constants to analyze material behavior and predict deformation. **SO2.5** Apply the concepts learned in elastic constants, thermal stresses, and composite section analysis to solve real-world engineering problems.	1. To observe the behavior of materials under load, to calculate the value of E, ultimate stress, permissible stress, 2. Analysis of materials under load, to calculate percentage elongation etc. and its fracture.	Unit-2 **Elastic Constants and Their Relationship** 2.1 Elastic constants, their relationship and volume changes. 2.2 Numerical on Elastic constants, their relationship. 2.3 Thermal stresses, 2.4 Numerical on Thermal stresses 2.5 Composite section and their equation formulations.	i. Study of various types of composite sections used in engineering.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical problems on composite sections.

AE 207 .3: Understanding and applying energy principles to solve stress and strain problems, including gradual and sudden force applications and utilizing Mohr circle for complex stress analysis for stress problems**.**

Approximate Hours

Item	AppX Hrs
Cl	7
LI	6
SW	1
SL	1
Total	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 Understanding the application of energy principles in solving stress and strain problems. **SO3.2** Concept of resilience and the modulus of resilience, and the ability to derive formulas for different cases of stress and strain. **SO3.3** understanding complex stress through the Mohr circle method and its application in solving complex stress problems. **SO3.4** Comparison of analytical and graphical solutions for complex stress problems **SO3.5** Application of theoretical knowledge to real-world engineering problems.	1. To study load deflection and other physical properties of closely coiled helical spring in tension and compression. 2. To study the Brinell's Hardness tests on the given specimens. 3. To determine fatigue strength of a given specimen.	**Unit-3: Advanced Mechanics of Materials: Energy Methods and Stress Analysis** 3.1 Use of energy principle in solving problems stress and strain due to gradual, sudden application of forces, impact and shock loading. 3.2 resilience, modulus of resilience 3.3 Complex stress, derivation of formulas for different cases. 3.4 Mohr circle and its application in solving complex stress problem. 3.5 Comparison of analytical and graphical solution of complex stress problem. 3.6 Tutorial-1 3.7 Tutorial-2	Study of various properties of materials.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Numerical problems on Mohr circle in solving complex stress problem.

AE 207 .4: Ability to analyze and predict the slope, deflection, and internal forces in beams using integration methods, moment area theorems, and conjugate beam method.

Approximate Hours

Item	AppXHrs
Cl	5
LI	4
SW	1
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO4.1 Understand the key principles of Slope and deflection of beams. **SO4.2** Understand the principles of integration technique its application. **SO4.3** Analyze the importance of moment area theorems. **SO4.4** Gain knowledge of Conjugate beam method.	1. To determine Young's modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points. 2. To write detail report emphasizing engineering importance of performing tension, compression, bending, torsion, impact and hardness tests on the materials.	**Unit-4 Advanced Beam Analysis Techniques** 4.1 Slope and deflection of beams 4.2 integration technique 4.3 moment area theorems 4.4 Conjugate beam method. 4.5 Tutorial-3	1. Why study of Slope and deflection of beams is important.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical problems on Slope and deflection of beams.

AE 207 .5: To analyze and design structural elements like beams, columns, and connections considering stability and deflection under various loading conditions.

Approximate Hours

Item	Appx Hrs
Cl	6
LI	-
SW	1
SL	2
Total	10

Session Outcomes (SOs)	**(LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Analyze the behavior of columns and struts under various loading conditions, including axial compression and eccentricity. **SO5.2** Calculate the strength and capacity of riveted and welded connections based on relevant design equations and standards. **SO5.3** Describe the key components and features of masonry dams and their structural behavior under various hydraulic and seismic loading conditions. **SO5.4** Define intermediate beams and propped beams and differentiate them from other types of beams in structural engineering. **SO5.5** Understand the concepts of fixed and continuous beams.		**Unit 5 Structural Elements and Connections** 5.1 Columns and Struts. 5.2 Riveted and welded connections. 5.3 Stability of masonry dams. 5.4 Introduction to intermediate beams, Propped beams. 5.5 Fixed and continuous beams. 5.6 Tutorial-4	1. Role of columns and struts in structure. 2. Use of various types of beams.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Numerical problems on Riveted and welded connections.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	LI	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
AE207.1: Understanding of basic mechanics and material behavior through topics such as stress, strain, direct and shear stress, free body diagrams and Poisson's ratio.	7	6	1	1	15
AE207.2: Understanding elastic constants, their interrelationships, and their impact on volume changes in materials.	5	4	1	1	11
AE207.3: Understanding and applying energy principles to solve stress and strain problems, including gradual and sudden force applications and utilizing Mohr circle for complex stress analysis for stress problems.	7	6	1	1	15
AE207 .4: Ability to analyze and predict the slope, deflection, and internal forces in beams using integration methods, moment area theorems, and conjugate beam method.	5	4	1	1	11
AE207 .5: to analyze and design structural elements like beams, columns, and connections considering stability and deflection under various loading conditions.	6	-	1	2	9
Total Hours	30	20	5	6	61

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Fundamentals of Stress and Strain Analysis	01	02	03	06
CO-2	Elastic Constants and Their Relationship	01	03	07	11
CO-3	Advanced Mechanics of Materials: Energy Methods and Stress Analysis	01	07	04	12
CO-4	Advanced Beam Analysis Techniques	01	06	04	11
CO-5	Structural Elements and Connections	01	06	03	10
Total		5	24	21	50

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

The end of semester assessment for Production and Operation 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:

2. Improved Lecture
3. Tutorial
4. Case Method
5. Group Discussion
6. Role Play
7. Visit to industry
8. Demonstration
9. ICT Based Teaching Learning (Video Demonstration/ Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
10. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Strength of Materials and Mechanics of Structures, Vol. I & II	Khurmi, R.S.	Khanna Publishers, New Delhi.	1998
2	A Textbook of Strength of Materials	Bansal R.K.	Laxmi Publications,New Delhi	
3	Strength of Materials	Timoshenko, S.P. and Young, D.H.	East- West Press Pvt. Ltd., New Delhi.	1968
4	Lecture notes provided by Dept. of Agricultural Engineering, AKS University, Satna			

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22ME227

Course Title: Strength of Materials

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Understanding of basic mechanics and material behavior through topics such as stress, strain, direct and shear stress, free body diagrams and Poisson's ratio.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Understanding elastic constants, their interrelationships, and their impact on volume changes in materials.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3: Understanding and applying energy principles to solve stress and strain problems, including gradual and sudden force applications and utilizing Mohr circle for complex stress analysis for stress problems.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO 4: Ability to analyze and predict the slope, deflection, and internal forces in beams using integration methods, moment area theorems, and conjugate beam method.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: to analyze and design structural elements like beams, columns, and connections considering stability and deflection under various loading conditions.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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	CO-1: Understanding of basic mechanics and material behavior through topics such as stress, strain, direct and shear stress, free body diagrams and Poisson's ratio.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1: Introduction 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4	CO 2: Understanding elastic constants, their interrelationships, and their impact on volume changes in materials.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 2.1,2.2,2.3,2.4,2.5,	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4	CO3 : Understanding and applying energy principles to solve stress and strain problems, including gradual and sudden force applications and utilizing Mohr circle for complex stress analysis for stress problems.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4	CO 4: Ability to analyze and predict the slope, deflection, and internal forces in beams using integration methods, moment area theorems, and conjugate beam method.	SO4.1 SO4.2 SO4.3 SO4.4		Unit-4 4.1, 4.2, 4.3, 4.4, 4.5	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1, 2, 3, 4	CO 5: to analyze and design structural elements like beams, columns, and connections considering stability and deflection under various loading conditions.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit-5 5.1, 5.2, 5.3, 5.4, 5.5, 5.6,	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme
Semester-II

Course Code:	**22CA228**
Course Title :	Web Designing and Internet Applications
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:	Web designing and internet applications are essential for creating engaging, accessible, and functional online experiences that meet the needs of users while achieving the goals of businesses and organizations.

Course Outcomes (CO):

AE 208.1	Students will gain a solid understanding of the basic principles of web design, including layout, typography, color theory, and user interface design using HTML, CSS.
AE 208.1	Students will learn various techniques for designing navigation bars, such as using menus, dropdowns and navigation icons, to create user-friendly and easy-to-navigate websites.
AE 208.1	Students will learn about the history and development of the internet, starting from its origins in ARPANET, www and web tool
AE 208.1	Students will be able to declare variables, assign values, and manipulate data using functions. How to interact with users through JavaScript using various methods such as alert, confirm, and prompt to display messages, obtain user input, and confirm actions.

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)	
BSC	**22CA228**	Web Designing and Internet Applications	1	1	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

(Theory + Practical):

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
BSC	22CA228	**Web Designing and Internet Applications (Theory)**	0	15	15	0	0	30	50	80
		Web Designing and Internet Applications (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 208.1 Students will gain a solid understanding of the basic principles of web design, including layout, typography, color theory, and user interface design using HTML, CSS.

Approximate Hours

Item	CL	LI	SW	SL	Total
Approximate Hours	**03**	**06**	**00**	**00**	**09**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understanding basic principles and rules for creating a website **SO1.2** Understanding planning process of web designing	**LI 1.1** DREAM WEAVER :Exploring Dreamweaver Interface **LI 1.2** Planning & Setting Web Site Structure **LI 1.3** FLASH: Animation concept FPS	**Unit-1** **1.1** Describe the **b**asic principles in developing a web designing **1.2** Describe the planning process of web designing **1.3** Describe the five golden rules of web designing	

SW-1 Suggested Sessional Work (SW):

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

AE 208.2 Students will learn various techniques for designing navigation bars, such as using menus, dropdowns and navigation icons, to create user-friendly and easy-to-navigate websites.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs	**04**	**O8**	**01**	**01**	**14**

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learnin g (SL)**
SO2.1 Understanding the creating a web site using html tag and css **SO2.2** Understanding the formatting tag using webpage	**LI 2.1** Planning & Setting Web Site Structure **LI 2.2** To apply working with panels **LI 2.3** Using property inspector, Formatting text **LI 2.4** Understanding and switching views	**Unit-2** **2.1** Describe the navigation bar **2.2** Describe the Concept of web design and web tools. **2.**3 Describe the home page layout **2.**4 Describe the page design using html and css	**1** How to apply CSS in html code

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Write html code to display the detail information of AKS University.

b. Mini Project:

c. Other Activities (Specify):

Note:

AE 208.3 Students will learn about the history and development of the internet, starting from its origins in ARPANET, www and web tool

Approximate Hours

Item	**CL**	**LI**	**SW**	**SL**	**Total**
AppX Hrs	**04**	**08**	**01**	**01**	**14**

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)** **Unit-3**	**Self Learning (SL)**
SO3.1 Understanding the html elements **SO3.2** Understanding the internet and www	**LI 3.1** Creating basic web banners **LI 3.2** Creating web banners with effects, Creating animated web buttons **LI 3.3** Using Control panel, FTP uploading site **LI 3.4** To apply gif animation interface	**3.1** Describe the html elements using web design **3.2** Describe the History of Internet and its application **3.3** Describe the World Wide Web and its features **3.4** Describe the creation of a web site and inserting image in web page	**1** How to create a hyperlink one page to another page

SW-3 Suggested Sessional Work (SW):

a. Assignments:
   Write html code to display background image in web page
b. Other Activities (Specify):

AE208.4 Students will be able to declare variables, assign values, and manipulate data using functions. How to interact with users through JavaScript using various methods such as alert, confirm, and prompt to display messages, obtain user input, and confirm actions.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs	04	08	01	01	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI) Unit-4	Self Learning (SL)
SO4.1 Understanding java scripting, variable and functions **SO4.2** Understanding connectivity of database with web page	**LI 4.1** Working with alert, confirm and prompt **LI 4.2** Creating rollover image in web page **LI 4.3** Working with operator **LI 4.4** To apply loop program using java scripting	**4.1** Describe the introduce of java script **4.2** Describe the variables & functions **4.3** Describe the alert, confirm and prompt **4.4** Connectivity of Web pages with databases	**1** Creating array program using java scripting

SW-4 Suggested Sessional Work (SW):

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

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self Learning (SL)	Total Hours (CL+SW+SL)
AE208.1 Students will gain a solid understanding of the basic principles of web design, including layout, typography, color theory, and user interface design using HTML, CSS.	03	00	00	03
Students will learn various techniques for designing navigation bars, such as using menus, dropdowns and navigation icons, to create user-friendly and easy-to-navigate websites.	04	01	01	06
Students will learn about the history and development of the internet, starting from its origins in ARPANET, www and web tool	04	01	01	06
Students will be able to declare variables, assign values, and manipulate data using functions. How to interact with users through JavaScript using various methods such as alert, confirm, and prompt to display messages, obtain user input, and confirm actions.	04	01	01	06
Total	15	03	03	21

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Students will gain a solid understanding of the basic principles of web design, including layout, typography, color theory, and user interface design using HTML, CSS.	02	04	07	13
CO-2	Students will learn various techniques for designing navigation bars, such as using menus, dropdowns and navigation icons, to create user-friendly and easy-to-navigate websites.	02	04	06	12
CO-3	Students will learn about the history and development of the internet, starting from its origins in ARPANET, www and web tool	04	04	04	12
CO-4	Students will be able to declare variables, assign values, and manipulate data using functions. How to interact with users through JavaScript using various methods such as alert, confirm, and prompt to display messages, obtain user input, and confirm actions.	03	04	06	13
Total		11	16	23	**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 (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Instagram, WhatsApp, Mobile and other Online sources)
7. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Elements of Workshop technology	Hazra, Choudari S K and Bose S. K.	Media Promoters and Publishers Pvt.Ltd.	1982 (Vol. I and II)
2	A Course in Workshop Technology	Raghuwamsi B S.	Dhan Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi.	1996 (Vol. I and II)

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22CA228

Course Title: Web Designing and Internet Applications

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1 Students will gain a solid understanding of the basic principles of web design, including layout, typography, color theory, and user interface design using HTML, CSS.	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**1**
CO2 Students will learn various techniques for designing navigation bars, such as using menus, dropdowns and navigation icons, to create user-friendly and easy-to-navigate websites.	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**1**
CO3 Students will learn about the history and development of the internet, starting from its origins in ARPANET, www and web tool	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**1**
CO4 Students will be able to declare variables, assign values, and manipulate data using functions. How to interact with users through JavaScript using various methods such as alert, confirm, and prompt to display messages, obtain user input, and confirm actions.	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**1**

Legend: 1 – Low, 2 – Medium, 3 – High

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	**CO1** Students will gain a solid understanding of the basic principles of web design, including layout, typography, color theory, and user interface design using HTML, CSS.	**SO1.1 SO1.2**	**1,2,3**	**1,2,3**	**0**
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	**CO2** Students will learn various techniques for designing navigation bars, such as using menus, dropdowns and navigation icons, to create user-friendly and easy-to-navigate websites.	**SO2.1 SO2.2**	**1,2,3,4**	**1,2,3,4**	**1**
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	**CO3** Students will learn about the history and development of the internet, starting from its origins in ARPANET, www and web tool	**SO3.1 SO3.2**	**1,2,3,4**	**1,2,3,4**	**1**
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	**CO4** Students will be able to declare variables, assign values, and manipulate data using functions. How to interact with users through JavaScript using various methods such as alert, confirm, and prompt to display messages, obtain user input, and confirm actions.	**SO4.1 SO4.2**	**1,2,3,4**	**1,2,3,4**	**1**

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code: 22HO322

Course Title: Principles of Horticultural crops and Plant Protection.

Pre- requisite: The Student should have basic knowledge of all principle of Horticulture Science to be implemented for boosting up the Production of Horticultural crops in well refined and sound manners.

Rationale: Horticulture has been recognized as Mother branch of Agriculture as their is immense potential to Compensate the Production and Productivity by applying all the basic fundamentals and Principles of this science to be beacon of light for the success of the Horticultural Additionally, the understanding of Post Harvest practices, Handling, Seed extraction techniques has been well clarified to check the Post Harvest losses and seed multiplication.

Course Outcomes:

AE 301.1: To understand about scope, Soil and Climatic requirements and Improved varieties of Horticultural crops.

AE 301.2: Students will have the ability to apply the Knowledge of Site selection including Nursery raising techniques and different Planting Methods.

AE 301.3: Student will be able to Understand Macro and Micro Propagation techniques including several Hi-Tech advanced practices of Horticultural crops.

AE 301.4: Understanding about Different concepts of Fertilizers and Irrigation methods including fertigation.

AE 301.5: Idea on Garden tools and Different Post Harvest practices, Insects Pests and Diseases and their management.

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 CI+LI+SW+SL	
Basic Science (BSC)	**22HO322**	Principles of Horticultural crops and Plant Protection.	1	1	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
BSC	**22AE523**	**Principles of Horticultural crops and Plant Protection. (Theory)**	0	15	15	0	0	30	50	80
		Principles of Horticultural crops and Plant Protection. (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE-301.1: To understand basic concepts of Scope, Soil and Climatic requirements and Improved varieties of Horticultural crops.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	3	2	2	2	09

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand about scope of Horticulture. **SO1.2** Understand about Soil and Climatic requirements of Horticultural crops. **SO1.3** Understand about Improved varieties of Horticultural crops. **SO1.4** Estimate the space needed for different agricultural operations based on factors like herd size, storage needs, and machinery requirements. **SO1.5** Understand the essential standards parameters regarding livestock production.	1.1 Identification and description of different Fruits, flowers and vegetable	**Unit-1.0 Horticultural Crop Production Systems.** 1.1. Scope of Horticulture. 1.2. Soil and Climate for Horticultural crops. 1.3. Improved varieties of Horticultural crops.	1. Scope of Horticulture. 2. Improved Varieties of Horticultural crops.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   Concepts of Scope of Horticultural crops.
b. **Mini Project:**
   Preparation of chart showing different Soil and Climatic requirements for Horticultural crops.

AE-301.2: Students will have the ability to apply the Knowledge of Criteria of selection, Layout and Planting Methods including commercial varieties/Hybrids, Seed rate and seed treatment of vegetable crops.

Approximate Hours

Item	**CL**	**LI**	**SW**	**SL**	**Total**
Appx. Hrs	**3**	**2**	**1**	**2**	**8**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Understand the concepts of Selection criteria for Horticultural crops. **SO2.2**Understand the different Planting Methods. **SO2.3**Understand the Commercial varieties/Hybrids including Seed rate and seed treatment of vegetable crops.	• Preparation of Nursery beds.	**Unit2.0 : Principles of Vegetable Crop Production** 2.1. Techniques of selection of Horticultural crops. 2.2 Different Planting Methods and commercial varieties/Hybrids. 2.3Seed rate and seed treatment of vegetable crops.	1. Commercial varieties/ Hybrids. 2. Different seed rate and seed treatment of vegetable crops.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. **Various selection criteria for Horticultural crops.**

b. Mini Project:

1. Preparation of Chart showing Different Planting Method.

c. Other Activities (Specify):

AE-301.3: Student will be able to understand Different Propagation techniques in Horticultural crops, Crop -Coefficients and Water requirements of Horticultural crops.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	3	2	1	2	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1. Understand the concepts of Propagation. **SO3.2.** Understand about Micro and Macro propagation. **SO3.3.** Understand the concepts of Plant growing structures. **SO3.4.** Understand the crop-coefficient and water requirements for Horticultural crops.	**1**. Visit to Commercial Polyhouses / Greenhouses.	**Unit 3.- Propagation Methods and Plant Management** **3.1.** Micro and Macro propagation techniques in Horticultural crops. **3.2.** Facilitating Different Plant growing structures. **3.3** Crop -Coefficients and Water requirements for Horticultural crops.	**1.** Different types of Plant growing structures **2.** Propagation techniques.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   Note on Different Plant growing structures.
b. **Mini Project:**

c. **Other Activities (Specify): Visit to commercial Polyhouses/Greenhouses.**

AE-301.4: Understanding Fertilizer applications, Irrigation methods and different Post Harvest practices.

Approximate Hours

Item	**CL**	**LI**	**SW**	**SL**	**Total**
Appx. Hrs	**3**	**2**	**1**	**2**	**8**

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO4.1. Understand the Fertilizer Applications. **SO4.2**. Understand the fertigation. **SO4.3** Understand the different irrigation methods and Post Harvest practices.	• Cultural operations of vegetable crops (Sowing, Weeding etc).	**Unit 4. Fertilization and Irrigation Techniques in Horticulture** **4.1** Understand the concepts of Fertilizer applications and fertigation in Horticultural crops. **4.2**. Different irrigation methods. **4.3** Post Harvest practices.	1. Concepts of fertigation. 2. Different Post Harvest practices.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Fertilizer application and Fertigation.
b. **Mini Project:**
   i. Prepare chart showing different Irrigation methods.
c. **Other Activities (Specify):**

AE-301.5: Understand the concepts of Garden tools seed Extraction and storage, Major insects, Pests and Diseases of Horticultural crops.

Approximate Hours

Item	**CL**	**LI**	**SW**	**SL**	**Total**
Appx. Hrs	**3**	**2**	**1**	**2**	**8**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1. Understand the concepts of Garden tools. **SO5.2.** Understand Seed Extraction and storage. **SO5.3.** Understand different Insects, Pests and Diseases of Horticultural crops.	1.1 Study of different garden tools.	**Unit-5. Horticultural Tools and Orchard Management** **1.1.** Operation of different garden tools. **1.2.** Seed Extraction and storage. **1.3.** Different types of insects, pests and Diseases of Horticultural crops.	**1.** Garden tools. **2.** Different types of Insects, Pests and Diseases of Horticultural crops.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Different types of garden tools.
b. **Mini Project:**
   i Prepare chart showing different problems in Horticultural crops.

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)
AE-301.1: To understand about scope, Soil and Climatic requirements and Improved varieties of Horticultural crops.	**3**	**2**	**2**	**7**
AE-301.2: Students will have the ability to apply the Knowledge of Site selection including Nursery raising techniques and different Planting Methods.	**3**	**2**	**2**	**7**
AE-301.3: Student will be able to Understand Macro and Micro Propagation techniques including several Hi-Tech advanced practices of Horticultural crops.	**3**	**2**	**2**	**7**
AE-301.4: Understanding about Different concepts of Fertilizers and Irrigation methods including fertigation.	**3**	**2**	**2**	**7**
AE-301.5: Idea on Garden tools and Different Post Harvest practices, Insects Pests and Diseases and their management.	**3**	**2**	**2**	**7**
Total Hours	**15**	**10**	**10**	**35**

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

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Identification and description of important Fruits, flowers and vegetable crops.	**5**	**2**	**3**	**10**
CO 2	Practice of Preparation of Nursery beds.	**3**	**2**	**4**	**9**
CO 3	Visit to commercial Polyhouses/Greenhouses.	**3**	**3**	**4**	**10**
CO 4	Cultural operations in vegetable crops.	**0**	**5**	**5**	**10**
CO 5	Study of different garden tools.	**3**	**3**	**4**	**10**
Total		**14**	**15**	**20**	**49**

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

The end of semester assessment for Principles of Horticultural Crops & Plant Protection 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

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to seed processing plants
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	Horticulture in India.	Bansal, PC	CBS Publishers, New Delhi	2008.
2	Post Harvest Management of Horticultural crops.	Saraswathy, Setal.	Agribios Newsletter, jodhpur.	2007.
3	Diseases of Horticultural crops.	G, Arjunan etal.	AE Publications, Coimbatore.	1999.
4	Advances in vegetable breeding	Singh, Pundhan	Kalyani Publishers, New Delhi.	2002.
5	Post Harvest Diseases of Horticultural crops.	Sharma, Neeta and Alam, Mashkoor	International Publishing house Co. UP	1997

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering
Course Code: 22AE523
Course Title: Principles of Horticultural Crops & Plant Protection

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1: To understand about scope, Soil and Climatic requirements and Improved varieties of Horticultural crops.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	3
CO-2 Students will have the ability to apply the Knowledge of Site selection including Nursery raising techniques and different Planting Methods.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-3 Student will be able to Understand Macro and Micro Propagation techniques including several Hi-Tech advanced practices of Horticultural crops	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Understanding about Different concepts of Fertilizers and Irrigation methods including fertigation.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 Idea on Garden tools and Different Post Harvest practices, Insects Pests and Diseases and their management	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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** Apply knowledge of engineering principles to the design, construction, operation, and maintenance of agricultural structures and environmental control systems.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	**AE 502. Horticultural Crop Production Systems** 1.**1,1.2,1.3**	As Mentioned along with the concern units
PO 1, 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 apply the Knowledge of Site selection including Nursery raising techniques and different Planting Methods.	SO2.1 SO2.2 SO2.3		**AE 502.2 Principles of Vegetable Crop Production** 2.1,2.2,2.3	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-3** Student will be able to Understand Macro and Micro Propagation techniques including several Hi-Tech advanced practices of Horticultural crops	SO3.1 SO3.2 SO3.3 SO3.4		**AE 502.3 Propagation Methods and Plant Management** 3.1,3.2,3.3	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-4** Understanding about Different concepts of Fertilizers and Irrigation methods	SO4.1 SO4.2 SO4.3		**AE 502.4 Fertilization and Irrigation Techniques in Horticulture** **4.1,4.2,4.3**	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-5** Idea on Garden tools and Different Post Harvest practices, Insects Pests and Diseases and their management	SO5.1 SO5.2 SO5.3		**AE 502.5 Horticultural Tools and Orchard Management** 5.1,5.2,5.3	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code: **22AN323**

Course Title: **Principles of Agronomy**

Pre-requisite: Student should have basic knowledge of Agronomy, Crop geometry, crop nutrition, Irrigation and weed and its management and about the allelopathy, growth and development and crop adaptation.

Rationale: The students should be acquainted with the knowledge of Agronomy its scope and importance and also know about the seed and method of sowing. They are involved in know about the crop nutrition to get the maximum yield without damaging the soil. The students should be acquainted with the knowledge of weed and its management and herbicide. Student also gets the knowledge about the crop growth and development and crop adaptation. This field of study and practice is driven by several key factors and considerations: Safety, Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

AE 302.1: Students acquaint will familiar with the knowledge of Agronomy and its scope and importance and know the seed and importance of plant population in the field and nutrient use efficiency

AE 302.2: Students will be able to do basic agronomic operations like sowing, fertilizer application, irrigation etc.

AE 302.3: Students will be able to schedule agronomy practices in a crop

AE 302.4: Students will able to acquaints knowledge about Water resources in India and water relationship with soil and plant and irrigation and its method and importance of irrigation.

AE 302.5: Learn basic cost estimation techniques for agricultural structures, considering materials, labor, and equipment requirements.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Basic Science (BSC)	22AN323	Principles of Agronomy	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/ Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
(BSC)	22AN323	**Principles of Agronomy (Theory)**	0	15	15	0	0	30	50	80
		Principles of Agronomy (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 302.1: Students acquaint will familiar with the knowledge of Agronomy and its scope and importance and know the seed and importance of plant population in the field and nutrient use efficiency.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	2	1	1	08

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the agronomy and importance of agronomy in present scenario. **SO1.2**Understand the Principles of agronomy. **SO1.3** Understand the Classification of crops **SO1.4**Understand theEffect of different weather parameters on crop growth and development.	1.1 Identification of crops and their varieties, seeds, manures, fertilizers.	**Unit-1 Introduction and scope of agronomy.** **1.1** Introduction toAgronomy **1.2** Scope of agronomy. **1.3** Importance of agronomy. **1.2** Principles of agronomy. **1.3**Classification of crops **1.4**.Effect of different weather parameters on crop growth and development.	1.1 Study on weather parameter.

SW-1 Suggested Sessional Work (SW):

Assignments:

What is Agronomy? Definition, scope and its importance.

Other Activities (Specify):

.

AE 302. 2 Students will be able to do basic agronomic operations like sowing, fertilizer application, irrigation etc.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	2	2	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1: Understand the Principles of Tillage, Tilth, and Their Characteristics. SO2.2: Understand the Crop Seasons, Methods, Time, and Depth of Sowing of Major Field Crops. SO2.3: Understand the Methods and Time of Application of Manures and Fertilizers.	1. Fertilizer application methods.	**Unit 2: Tillage & Sowing Practices** 1.1 Principles of Tillage 1.2 Tilth hand its Characteristics. 1.3 Introduction to Crop Seasons. 1.4 Methods, Time, and Depth of Sowing of Major Field Crops. 1.5 Explanation of Methods and Time of Application of Manures 1.6 Fertilizers	1.Study on types of tillage

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the irrigation- scheduling criteria and methods, quality of irrigation water, water logging.

b. Other Activities (Specify):

i. Estimation of water requirement of rice crop in kharif season.

AE 302. 3 Students will be able to schedule agronomic practices in a crop

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	2	2	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Understand the Crop rotation and its principles **SO3.2** Understand the crop adaptation and distribution of crops **SO3.3** Understand the Cropping systems, Relay cropping **SO3.4**. Understand the to mixed cropping, crop management technologies in problematic areas.	i. Practice of ploughing Practice of Puddling	**Unit-3 Crop rotation** **1.1**Crop rotation and its principles **1.2**Adaptation and distribution of crops. **1.3**.Introduction to Cropping systems, **1.4** Relay cropping **1.5**Introduction to mixed cropping, **1.6** **C**rop management technologies in problematic areas.	1.Study on effect of weed on crop and crop on weeds.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain Adaptation and distribution of crops and harvesting and threshing of crops

b. Other Activities (Specify):

AE 302.4 Students will able to acquaints knowledge about Water resources in India and water relationship with soil and plant and irrigation and its method and importance of irrigation.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	2	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Explain the Soil water plant relationship **SO4.**2 Understand the crop water requirement **SO4.3** Understand the water use efficiency **SO4.4**. Understand the irrigation-scheduling criteria and methods **SO4.5**Understand the crop coefficients, critical stages for irrigation,	1.1 Practice of sowing.	**Unit-4 Soil water plant relationship** **1.1**Soil water plant relationship. **1.2**Explain to water use efficiency. **1.3**. Explain to irrigation-scheduling criteria and methods. **1.4**Introduction to crop coefficients. **1.5.** Explain the concept of critical stages for irrigation	1.Study on plant crop rotation and its principles.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Growth and development of crops. Factors affecting growth and development

b. Other Activities (Specify):

AE 302.5 Students will able to acquaint knowledge to Adaptation and distribution of crops crop management technologies of crop in problematic areas harvesting and threshing of crops.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	7	2	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand the weed importance classification of weed. **SO5.2**Understand the crop weed competition and weed management. **SO5.3** Understand the Organic Farming-Sustainable agriculture.	1.1 Identification of weeds. 1.2 Different weed control methods.	**Unit-5 Weeds and its importance** **1.1.** Introduction to weed **1.2.** Characteristics of weed and its importance. **1.3.** Classification of weeds **1.4.** Crop weed competition and its effect on crop production **1.5.** Introduction to concept of weed management. **1.6.** Introduction to Organic Farming- **1.7.** Sustainable agriculture	1.1 Study on weeds.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:** Explain the weed control method.
b. **Other Activities (Specify):**

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+SW+SL)
AE 302.1 Students acquaint will familiar with the knowledge of Agronomy and its scope and importance and know the seed and importance of plant population in the field and nutrient use efficiency.	6	2	1	0	9
AE 302. 2 Students will be able to do basic agronomic operations like sowing, fertilizer application, irrigation etc.	6	2	1	1	10
AE 302.3 Students will be able to schedule agronomy practices in a crop.	6	2	1	1	10
AE 302.4 students will able to acquaints knowledge about Water resources in india and water relationship with soil and plant and irrigation and its method and importance of irrigation.	5	2	1	1	9
AE 302.5 Students will able to identify the weed and agronomical problem create by the weed and its management	7	2	1	1	11
Total Hours	30	10	5	4	49

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction and scope of agronomy.	03	01	01	05
CO-2	Tillage & Sowing Practices	02	06	02	10
CO-3	Crop rotation	03	07	05	15
CO-4	Soil water plant relationship	-	10	05	15
CO-5	Weeds and its importance	03	02	-	05
Total Hours		11	26	13	50

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

The end of semester assessment for fundamentals of Agronomy 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role-play
6. Visit to agronomy field
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	Principles of Agronomy	Reddy YellamandaT and Shankar Reddy G H	Kalyani Publishers Ludhiana.	1995
2	Meteorology	William L Donn	McGraw-Hill Book Co. New York	1965
3	Crop Production in Dry Regions	L. Arnon	Leonard Hill Publishing Co. London	1972
4	Manures and Fertilizers	Yawalkar K S and Agarwal JP	Agricultural Horticultural Publishing House, Nagpur.	1977

Curriculum Development Team

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Cos, POs and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering

Course Code: 22AN323

Course Title: Principles of Agronomy

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1: Students acquaint will familiar with the knowledge of Agronomy and its scope and importance and know the seed and importance of plant population in the field and nutrient use efficiency.	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO 2: Students will be able to do basic agronomic operations like sowing, fertilizer application, irrigation etc.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO3: Students will be able to schedule agronomy practices in a crop	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO 4: Students will able to acquaints knowledge about Water resources in India and water relationship with soil and plant and irrigation and its method and importance of irrigation.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO 5: Learn basic cost estimation techniques for agricultural structures, considering materials, labor, and equipment requirements.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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)
PO1,2,3,4,5,6 PSO1,2,3,4	CO-1:Students acquaint will familiar with the knowledge of Agronomy and its scope and importance and know the seed and importance of plant population in the field and nutrient use efficiency	SO1.1 SO1.2 SO1.3 SO1.4	1.1 1.2	Unit-1.0 Introduction and scope of agronomy. 1.1,1.2,1.3,1.4,1.5,1.6	As Mentioned along with the concern units
PO1,2,3,4,5,6 PSO1,2,3,4	CO 2: Students will be able to do basic agronomic operations like sowing, fertilizer application, irrigation etc.	SO2.1 SO2.2 SO2.3	2.1 2.2	Unit-2 Tillage & sowing Practices 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO3: Students will be able to schedule agronomy practices in a crop	SO 3.1SO 3.2 SO3.3 SO 3.4	3.1 3.2	Unit-3: Crop rotation 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 4: Students will able to acquaints knowledge about Water resources in India and water relationship with soil and plant and irrigation and its method and importance of irrigation.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	3.1 3.2	Unit-4: Soil water plant relationship 4.1,4.2,4.3,4.4,4.5	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 5: Learn basic cost estimation techniques for agricultural structures, considering materials, labor, and equipment requirements.	SO5.1 SO5.2 SO5.3	4.1 4.2	Unit5:Weeds and its importance 5.1,5.2,5.3,5.4,5.5,5.6,5.7	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code: 22SD324

Course Title: Communication Skills and Personality Development

Pre-requisite: Students must have basic knowledge of English language.

Rationale: Communication skills are integral to the success and sustainability of agriculture. They facilitate the exchange of knowledge, foster collaboration, empower farmers to make informed decisions, and contribute to the overall resilience of agricultural systems in the face of evolving challenges.

Course Outcomes:

AE 303.1: Student’s grammatical accuracy will be improved, leading to clearer and more effective communication in both academic and professional contexts.

AE 303.2: Student’s abilities will develop to comprehend, analyze, and interpret spoken and written language

AE 303.3: Student’s abilities will develop to effectively communicate information in written form

AE 303.4: Students ability will be enhanced to participate actively and constructively in group discussions and debates

AE 303.5: Students abilities will be developed to effectively plan, deliver, and engage an audience through spoken communication.

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)	
Humanities and Social Sciences including Management courses (HSMC)	**22SD324**	**Communication Skills and Personality Development**	**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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	22AE523	Communication Skills and Personality Development (Theory)	0	15	15	0	0	30	50	80
		Communication Skills and Personality Development (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 303.1: Student's grammatical accuracy will be improved, leading to clearer and more effective communication in both academic and professional contexts.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	9	6	1	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Students will learn the Proper use of prepositions which helps to create clear and coherent sentences. **SO1.2**Students will be able to explain the uses of different Models. **SO1.3**Students will have a clear understanding of the concept of tenses and their role in indicating the timing of actions in sentences. Practical **S01.1**Promotes learning and provides additional perspectives on correct usage of Preposition. **SO1.2** Students will be able to use modals to express possibilities and probabilities in both present and future contexts. **SO1.3** Students will develop the ability to identify and correct common errors related to tense usage.	• Make 20 sentences using different preposition • write any 5 uses of Modals • convert 10 sentences of present prefect tense into past perfect tense	**UNIT-1 FUNCTIONAL GRAMMAR** 1.1 Preposition. 1.2 Types of Prepositions 1.3 Practice Session 1.4 Modals. 1.5 Tenses Introduction 1.6 Present Tense Structure 1.7 Past Tense Structure 1.8 Future Tense Structure 1.9 Practice Questions	1. Create sentences using different Prepositions and identify the relationships they convey. 2. Find exercises or worksheets specifically focusing on Modals. 3. Prepare a presentation on TENSES and their structure.

AE 303.2: Student's abilities will be enhanced to effectively convey messages through spoken words, tone, body language, and other non-verbal cues.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	4	1	1	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Students will get familiar with the concept of communication **S02.2** Students will be able to do communication effectively **SO2.3** Students will learn the importance of verbal and non-verbal communication Practical **SO2.1** Students will get familiar with the concept of Non – Verbal Communication **SO2.2** Student will learn the importance of communication	• Explain Non – verbal communication. • Explain the concept of communication.	**UNIT-2 COMMUNICATION SKILLS** 1.1 Introduction to communication 1.2 Definition, Meaning Of communication. 1.3 Process of communication 1.4 Verbal communication 1.5 Non – verbal communication	1. Prepare a presentation on communication process. 2. Mention the elements of non-verbal communication.

AE 303.3: Students abilities will develop to comprehend, analyze, and interpret spoken and written language.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	4	1	1	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Students will apply listening skills to analyze and critically evaluate information presented through various media. **SO3.2** Students will develop note-taking strategies to capture key information during lectures or presentations. **SO3.3**Students will develop inferential skills, drawing conclusions, making predictions, and interpreting implicit meanings in written texts. Practical **SO3.1** Students will get familiar with various Reading strategies, **S03.2** Students will Learn the impact of types of listening	• Differentiate between various Reading Strategies and their Importance • Mention various types of listening	**UNIT-3 LISTENING AND READING SKILLS** 1.1 Introduction to listening skills 1.2 Listening process, 1.3 Listening and note taking 1.4 Reading Skills. 1.5 Reading Strategies	1. Prepare a presentation on Listening Process 2. Go through some articles and prepare a list of 20 new words 3. Mention some reading strategies

AE 303.4: Student's abilities will develop to effectively communicate information in written form.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	4	1	1	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Students will develop a professional and appropriate writing style for reports, ensuring coherence, cohesion, and a formal tone effectively **SO4.2** Students will demonstrate effective research skills, including the ability to gather, evaluate, and synthesize information from credible sources. **SO4.3** Students will demonstrate a clear understanding of the components and structure of different types of reports. Practical **SO4.1** Students will get familiar with different types of reports and their usage **SO4.2** Students Presentation Skills will develop .	• Mention types of report. • Present the Report Result	**UNIT-4 WRITING SKILLS** 1.1 Report writing, 1.2 Essentials of Report 1.3 Importance and purpose of Report 1.4 Types of Report. 1.5 Report Procedure	1. Prepare presentation on essentials of report. 2. Make a report on "Evaluating the effectiveness of natural pest control methods in agriculture".

AE 303.5: Students ability will be enhanced to participate actively and constructively in group discussions and debates, Students ' abilities will be developed to effectively plan, deliver, and engage an audience through spoken communication

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	4	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Students will demonstrate improved ability to plan and structure effective presentations. **SO5.2** Students will understand the purpose and benefits of group discussion. **SO5.3** Students will construct and present clear and compelling arguments. Practical **SO5.1**Students would be able to present their thoughts effectively **SO5.2**Students will learn the leadership skills.	• Group Discussion on the Topic (Problems & Issues of Agriculture in India.) • Spread Awareness among students to promote the use of organic fertilizer.	**UNIT-5 PRESENTATION** 1.1 Oral Presentation 1.2 Impromptu Presentation 1.3 Group Discussion 1.4 Public Speaking 1.5 Slogan Writing, Advertising 1.6 Debate	1. Prepare a speech on "Horticulture" 2. Write 10 slogans for any 5 brands. 3. Prepare a presentation on Debate

Brief of Hour suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
AE 303.1: Student's grammatical accuracy will be improved, leading to clearer and more effective communication in both academic and professional contexts.	9	6	1	1	17
AE 303.2: Students written and spoken communication skills will be enhanced through the application of active-passive voice, modals, narration, and translation.	5	4	1	1	11
AE 303.3: Students will be able to create impactful resumes and job application letters that enhance their chances of success in the job market.	5	4	1	1	11
AE 303.4: Students ability will be enhanced to participate actively and constructively in group discussions and debates, provide students with the knowledge and skills needed to navigate interviews successfully.	5	4	1	1	11
AE 303.5: Students writing skills will be enhanced for diverse purposes, including academic, professional, and creative contexts.	6	4	1	1	12
Total Hours	30	22	5	5	62

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Functional Grammar.	03	01	01	05
CO-2	Communication Skills.	02	06	02	10
CO-3	Listening and Reading Skills.	03	07	05	15
CO-4	Writing Skills.	-	10	05	15
CO-5	Presentation skills.	03	02	-	05
Total		11	26	13	50

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

Suggested Instructional/ Implementation Strategies:

1. ImprovedLecture
2. Tutorial
3. GroupDiscussion
4. Presentations
5. writings
6. Speeches
7. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Communication Skills	Sanjay Kumar	Oxford press.	1st edition,2011
2	Brilliant communication skills	Gill Hasson	Pearson life.	1st edition,2011
3	Living English personality Development and soft skill	Barun k mitra	Oxford press	1st edition,2011
4	Competitive English	V K Sinha	Jananada Publishers	17th edition 2016
5.	Soft skill and professional communication	Francis peters SJ	Mc Graw Hill	1st edition.

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech Agricultural Engineering

Course Code: 22SD324

Course Title: Communication Skills and Personality Development

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 investing actions 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	o make expertise in design nd engineering problem olving approach in griculture with proper	To enhance the ability of the students to formulate solutions to real-world problems pertaining to	To inculcate entrepreneurial skills through strong Industry-	bility to use the research ased innovative knowledge or sustainable development n Agricultural Engineering.
CO-1 Apply knowledge of engineering principles to the design, construction, operation, and maintenance of agricultural structures and environmental control systems.	-	-	-		1	1	1	2	3	3	1	2	2	3	3	3
CO-2 Analyze and solve problems related to the interaction of agricultural structures, the environment, plants, animals, and humans.	-	1	1	-	-	2	2	2	3	3	2	2	2	2	2	1
CO-3 Manage agricultural structures and environmental control systems for safety, efficiency, and sustainability.	-	-	-	-	-	-	-	-	2	3	1	2	3	2	2	1
CO-4 Select and use appropriate materials and technologies for the construction and operation of agricultural structures and environmental control systems.	-	-	-	-	-	-	-	2	3	3	-	2	3	3	3	2
CO-5 Communicate effectively with stakeholders on issues related to agricultural structures and environmental control and apply professional ethics and standards to the practice of agricultural engineering.	-	-	1	-	-	1	-	-	3	3	-	2	3	3	1	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,**	**CO-1** Student's grammatical accuracy will be improved, leading to clearer and more effective communication in both academic and professional contexts.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6**	**As Mentioned along with the concern units**	AE 303.1 Functional Grammar	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-2** Student's abilities will develop to comprehend, analyze, and interpret spoken and written language	**SO21** **SO2.2** **SO2.3** **SO2.4** **SO2.5**		AE 303.2 Communication Skills	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-3** Student's abilities will develop to effectively communicate information in written form	**SO3.1** **SO3.2** **SO3.3** **SO3.4** **SO3.5**		AE 303.3 Communication Skills	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-4** Students ability will be enhanced to participate actively and constructively in group discussions and debates	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5**		AE 303.4 Writing Skills	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-5** Students abilities will be developed to effectively plan, deliver, and engage an audience through spoken communication.	**SO5.1** **SO5.2** **SO5.3** **SO5.4** **SO5.5**		AE 303.5 Presentation	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code:	**22MS321**
Course Title:	**Engineering Mathematics - III**
Pre-requisite:	Student must have knowledge of calculus, differential equations, differential and integration.
Rationale:	To improve the student's skills in numerical methods by using the numerical analysis and to provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration.

Course Outcomes (CO):

AE 304.1 Understand the concept of discretization and its application to solving differential equations**,**apply finite difference methods to approximate derivatives and integrals**,** Recognize the stability and consistency properties of different difference schemes. By the end of the course, students should have a solid understanding of these topics and be able to apply their knowledge to solve a variety of mathematical and computational problems.

AE 304.2 By the end of the course, students should have a comprehensive understanding of interpolation techniques, their applications, and the considerations involved in choosing the most appropriate method for a given set of data.

AE 304.3 By the end of the course, students should be proficient in applying numerical techniques to solve problems related to derivatives, integrals, difference equations, and ordinary differential equations. They should also be able to critically evaluate the methods based on accuracy, stability, and computational efficiency.

AE 304.4 By the end of the course, students should be proficient in using Laplace transformation to solve ordinary and simultaneous differential equations. They should also be able to interpret the physical meaning of solutions and analyze the stability and transient responses of systems represented by Laplace-transformed equations.

AE 304.5 By the end of the course, students should be proficient in conducting various statistical tests, interpreting results, and applying hypothesis testing techniques to real-world problems. They should also be able to choose appropriate tests based on the nature of the data and the research question.

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 (CI+LI+SW+SL)	
Basic Science Course (BSC)	**22MS321**	**Engineering Mathematics -III**	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

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+ SA +CAT+AT)		
Basic Science Course (BSC)	**22MS321**	**Engineering Mathematics -III**	10	15	15	5	5	50	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.

AE 304.1 Understand the concept of discretization and its application to solving differential equations**,** apply finite difference methods to approximate derivatives and integrals**,** Recognize the stability and consistency properties of different difference schemes. By the end of the course, students should have a solid understanding of these topics and be able to apply their knowledge to solve a variety of mathematical and computational problems.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	9	0	2	2	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the concept of factorial notation and its representation **SO1.2**Understand the concept of discretization and its application to solving differential **SO1.3**Apply different types of difference operators based on the nature of the problem **SO1.4**Apply factorial notation in combinatorics and probability **SO1.5**Derive the central difference approximation for the second derivative of a function	-	**Unit-1.0** 1.1. Explanation of Finite difference method 1.2. Introduction of various difference operators 1.3. relationships between difference operators 1.4. Introduction of Factorial notation 1.5. Evaluation of function by Factorial notation. 1.6. Construction of missing value by constructing table 1.7. Evaluation of missing value by without constructing table 1.8. Interpolation with equal integrals 1.9. Tutorial-1	**SL.1**Solve real-world engineering and scientific problems using finite difference techniques **SL.2**Solve problems related to permutations and combinations using factorial notation **SL.3**Apply factorial notation to find the limit of a sequence

SW-1 Suggested Sessional Work (SW):
a. Assignments:

i. Write the formula of all operators.
ii. Construct a forward difference table.

b. Other Activities (Specify):
Quiz, Class Test.

AE 304.2 By the end of the course, students should have a comprehensive understanding of interpolation techniques, their applications, and the considerations involved in choosing the most appropriate method for a given set of data.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	9	0	2	2	12

Approximate Hours

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1 Understand the concept of interpolation and its importance in approximating values between given data points **SO2.2**Apply Newton's forward and backward interpolation formulas to estimate values within a set of equally spaced data points **SO2.3**Analyze the advantages and limitations of using equal intervals in interpolation **SO2.4**Understand the differences between forward and backward interpolation and when to use each **SO2.5**Derive Bessel's and Stirling's difference interpolation formulas	-	**Unit-2.0** 2.1 Newton's forward and Newton's backward interpolation formula. 2.2 Questions of Newton's forward 2.3 Newton's backward interpolation formula 2.4Sterling's difference interpolation formulae. 2.5 Questions of Sterling's formula 2.6. Interpolation with unequal intervals. 2.7. Newton's divided difference formula. 2.8 Lagrange's interpolation formula 2.9 Tutorial-1	**SL.1**Apply appropriate interpolation techniques to estimate values within sets of unevenly spaced data points. **SL.2**Understand the principles behind Lagrange's interpolation formula **SL.3**Use Newton's divided difference formula to interpolate values for both equal and unequal intervals

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write all the formula of interpolation.
ii. Write the application of different operators.

b. Mini Project:

Oral presentation, Power Point Presentation.

AE 304.3 By the end of the course, students should be proficient in applying numerical techniques to solve problems related to derivatives, integrals, difference equations, and ordinary differential equations. They should also be able to critically evaluate the methods based on accuracy, stability, and computational efficiency.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	9	0	1	3	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1 Understand the need for numerical differentiation in approximating derivatives **SO3.2** Apply various numerical differentiation methods, such as finite difference schemes, to approximate derivatives **SO3.3** Analyze the accuracy and stability of numerical differentiation techniques. **SO3.4** Grasp the importance of numerical integration in approximating definite integrals **SO3.5** Understand the basic principles of solving ODEs numerically	-	**Unit-3.0** 3.1. Numerical differentiations 3.2. Numerical integrations 3.3. Numerical Differentiation for forward and backward 3.4. Numerical Differentiatio n for backward 3.5. Ordinary differential equations 3.6. Numerical Solutions of ordinary differential equationsPicard's Taylor's series. 3.7. Euller's Method 3.8. Runga-Kutta method 3.9 Tutorial-1	**SL.1** Apply numerical integration methods, such as the trapezoidal rule and Simpson's rule, to approximate integrals. **SL.2** Evaluate the accuracy and convergence properties of numerical integration techniques **SL.3** Apply Picard's method and Taylor's series method and Euler's method to solve first-order ODEs

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write the applications of numerical integration.
ii. Calculate the error by exact and approximate solution of integration by one example.

AE 304.4 By the end of the course, students should be proficient in using Laplace transformation to solve ordinary and simultaneous differential equations. They should also be able to interpret the physical meaning of solutions and analyze the stability and transient responses of systems represented by Laplace-transformed equations.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	8	0	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Understand the concept of Laplace transformation and its significance in solving differential equations. **SO4.2** Apply Laplace transformation to transform ordinary and partial differential equations into algebraic equations **SO4.3** Grasp the properties of Laplace transforms and their applications. **SO4.4** Apply Laplace transformation to solve linear ordinary differential equations **SO4.5** Understand and use the Laplace transform of derivatives and integrals	-	**Unit-4.0** 4.1 Laplace transformation- 4.2 Properties of Laplace transformation 4.3 Questions of LI and properties 4.4 Inverse Laplace transformation 4.5 Questions of inverse Laplace transform 4.6 Applications of Laplace transformation to the solutions of ordinary differential equations. 4.7 Applications of Laplace transformation to the solutions of simultaneous differential equations 4.8 Tutorial-1	**SL.1** Solve systems of ordinary differential equations using Laplace transformation **SL.2** Apply the inverse Laplace transform to obtain the solution in the time domain **SL.3** Understand the concept of inverse Laplace transformation and its role in obtaining solutions in the time domain

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write all formula of Laplace transform.
ii. Write all formula of Inverse Laplace transform.
iii. Write about application of Laplace and Inverse Laplace transform.

b. Other Activities (Specify):
Quiz, Class Test.

AE 304.5 By the end of the course, students should be proficient in conducting various statistical tests, interpreting results, and applying hypothesis testing techniques to real-world problems. They should also be able to choose appropriate tests based on the nature of the data and the research question.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	10	0	1	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO5.1 Understand the concept of hypothesis testing and its role in statistical inference. **SO5.2** Formulate null and alternative hypotheses for different types of problems **SO5.3** Identify the level of significance and understand its significance in hypothesis testing. **SO5.4** Define and interpret the level of significance in hypothesis testing **SO5.5** Understand the concept of degrees of freedom and its relevance in various statistical tests.	-	**Unit-5.0** 5.1. Testing of Hypothesis 5.2. Level of Significance 5.3. Degrees of freedom 5.4 Large sample test (Z-test), 5.5. Small sample test t-test 5.6. Testing of Significance through variance (F-test), 5.7. Chi -Square test, 5.8. Contingency table 5.9. Correlation 5.10 Regression.	**SL.1** Differentiate between Type I and Type II errors in hypothesis testing **SL.2** Apply the Z-test to assess hypotheses about population parameters when dealing with large samples. **SL.3** Apply the t-test for one-tailed and two-tailed tests when dealing with small sample sizes

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write about real life examples of correlation and regration.

b. Other Activities (Specify):
Quiz, Class Test.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
CO1-Understand the concept of discretization and its application to solving differential equations**,** Apply finite difference methods to approximate derivatives and integrals**,** Recognize the stability and consistency properties of different difference schemes. By the end of the course, students should have a solid understanding of these topics and be able to apply their knowledge to solve a variety of mathematical and computational problems.	09	02	02	13
CO2-By the end of the course, students should have a comprehensive understanding of interpolation techniques, their applications, and the considerations involved in choosing the most appropriate method for a given set of data.	09	02	02	13
CO3-By the end of the course, students should be proficient in applying numerical techniques to solve problems related to derivatives, integrals, difference equations, and ordinary differential equations. They should also be able to critically evaluate the methods based on accuracy, stability, and computational efficiency.	09	01	03	13
CO4-By the end of the course, students should be proficient in using Laplace transformation to solve ordinary and simultaneous differential equations. They should also be able to interpret the physical meaning of solutions and analyze the stability and transient responses of systems represented by Laplace-transformed equations. .	08	1	1	10
CO5-By the end of the course, students should be proficient in conducting various statistical tests, interpreting results, and applying hypothesis testing techniques to real-world problems. They should also be able to choose appropriate tests based on the nature of the data and the research question.	10	1	01	12
Total Hours	45	7	9	61

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Numerical analysis-I	04	03	03	10
CO-2	Numerical analysis-II	03	04	03	10
CO-3	Numerical analysis-III	05	03	02	10
CO-4	Laplace transformation	05	04	01	10
CO-5	Testing of different sample	03	04	03	10
Total		20	18	12	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
2. Tutorial
3. Presentation
4. Group Discussion
5. Online sources
6. Seminar
7. Workshop

Suggested Learning Resources:

a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Engineering Mathematics-III	D. K. Jain. Engineering	Shree Ram Prakashan.	1st edition, 2018
2	Engineering Mathematics-III	D.C.Agrawal	Shree Sai Prakashan	2022
3	Introduction to Engineering	H.K.Dass	S Chand Prakashan.	2nd edition, 2014
4	Engineering Mathematics-III	Sonendra Gupta	Dhanpat Rai Publishing	
5	Higher Engineering Mathematics,	B.S.Grewal	Khanna Publishers	2005

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Cos, POs and PSOs Mapping

Course Title: B.Tech Agricultural Engineering
Course Code: 22MS321
Course Title: Engineering Mathematics-III

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1-Understand the concept of discretization and its application to solving differential equations**,** Apply finite difference methods to approximate derivatives and integrals**,** Recognize the stability and consistency properties of different difference schemes. By the end of the course, students should have a solid understanding of these topics and be able to apply their knowledge to solve a variety of mathematical and computational problems.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO2-By the end of the course, students should have a comprehensive understanding of interpolation techniques, their applications, and the considerations involved in choosing the most appropriate method for a given set of data.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3-By the end of the course, students should be proficient in applying numerical techniques to solve problems related to derivatives, integrals, difference equations, and ordinary differential equations. They should also be able to critically evaluate the methods based on accuracy, stability, and computational efficiency.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4-By the end of the course, students should be proficient in using Laplace transformation to solve ordinary and simultaneous differential equations. They should also be able to interpret the physical meaning of solutions and analyze the stability and transient responses of systems represented by Laplace-transformed equations.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5-By the end of the course, students should be proficient in conducting various statistical tests, interpreting results, and applying hypothesis testing techniques to real-world problems. They should also be able to choose appropriate tests based on the nature of the data and the research question.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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	CO1-Understand the concept of discretization and its application to solving differential equations, Apply finite difference methods to approximate derivatives and integrals, Recognize the stability and consistency properties of different difference schemes. By the end of the course, students should have a solid understanding of these topics and be able to apply their knowledge to solve a variety of mathematical and computational problems.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-1.0 Numerical analysis-I 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	SL1.1 SL1.2 SL1.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO2-By the end of the course, students should have a comprehensive understanding of interpolation techniques, their applications, and the considerations involved in choosing the most appropriate method for a given set of data.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-2 Numerical analysis-II 2.1,2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9	SL2.1 SL2.2 SL2.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3-By the end of the course, students should be proficient in applying numerical techniques to solve problems related to derivatives, integrals, difference equations, and ordinary differential equations. They should also be able to critically evaluate the methods based on accuracy, stability, and computational efficiency.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-3 Numerical analysis-III 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8,3.9	SL3.1 SL3.2 SL3.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO4-By the end of the course, students should be proficient in using Laplace transformation to solve ordinary and simultaneous differential equations. They should also be able to interpret the physical meaning of solutions and analyze the stability and transient responses of systems represented by Laplace-transformed equations.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-4 Laplace transformation 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8	SL4.1 SL4.2 SL4.3
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO5-By the end of the course, students should be proficient in conducting various statistical tests, interpreting results, and applying hypothesis testing techniques to real-world problems. They should also be able to choose appropriate tests based on the nature of the data and the research question	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit-5 Testing of different sample 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8,5.9,5.10	SL5.1 SL5.2 SL5.3

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code:	22CE325
Course Title:	Soil Mechanics
Pre-requisite:	To successfully understand and design effective solutions for soil and water conservation.
Rationale:	The students studying comprehensive understanding erosion of soil and its control. The course covers the fundamental concepts of soil erosion, including its causes, types, and effects. It also delves into the mechanics of water and wind erosion and explores various strategies for controlling these processes. Additionally, the course emphasizes the importance of land capability classification and sedimentation monitoring in managing soil erosion.

Course Outcomes:

AE 305.1: Introduction to Soil Mechanics and Stress Distribution

AE 305.2: Shear Strength and Laboratory Testing

AE 305.3: Compaction of Soils and Field Methods

AE 305.4: Consolidation of Soils and Settlement Analysis

AE 305.5: Earth Pressure and Slope Stability Analysis

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(ESC)	22CE325	Soil Mechanics	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ESC	22CE325	**Soil Mechanics (Theory)**	0	15	15	0	0	30	50	80
		Soil Mechanics (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE305.1: Introduction to Soil Mechanics and Stress Distribution
Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	7	8	2	2	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Define soil mechanics and explain its applications in various engineering fields. **SO1.2** Identify and classify soils based on particle size, texture, and Indian Standard system. **SO1.3** Calculate physical and index properties of soils. **SO1.4** Analyze stress conditions in soils and differentiate between effective and neutral stress. **SO1.5** Apply elementary concepts of stress distribution using Bousinesque and Westergaard's analysis and New mark's influence chart	**1.** Determination of water content of soil. **2.** Determination of specific gravity of soil. **3.** Determination of field density of soil by core cutter method. **4.** Grain size analysis by sieving (Dry sieve analysis)	**Unit-1.0 Introduction to Soil mechanics and Stress Distribution** **1.1** Field of soil mechanics. **1.2** Phase diagram **1.3** Physical and index properties of soil **1.4** Classification of soils **1.5** Effective and neutral stress **1.6** Elementary concept of Bousinesque and Wester guard's analysis **1.7** Newmark influence Chart	**1.** Explore the applications of soil mechanics in various engineering fields. **2.** Investigate the limitations of traditional soil classification systems.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Explore the applications of soil mechanics in various engineering fields.
- **ii.** Investigate the limitations of traditional soil classification systems.

b. Mini Project:

- **i.** Design a laboratory experiment to determine the specific gravity of soil particles.

c. Other Activities(Specify):

- **i.** Develop a flowchart for selecting the appropriate soil classification system for a given project.

AE305.2: Shear Strength and Laboratory Testing

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	5	6	2	2	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Construct and interpret Mohr stress circles. **SO2.2** Understand the relationship between principal stresses and apply Mohr-Coulomb failure theory to predict shear strength. **SO2.3** Explain the effective stress principle and its significance in soil behavior. **SO2.4** Determine shear parameters of soils using laboratory tests like direct shear and triaxial shear test. **SO2.5** Solve numerical problems related to shear strength and stress analysis.	**i.** Determination of shear parameters by Direct shear test. assessment **ii.** Determination of permeability by constant head method. **iii.** Determination of permeability by variable head method.	**Unit-2 Shear Strength of soils** **2.1** Shear strength Mohr stress circle, **2.2** Theoretical relationship between principal stress circle **2.3** Mohr-Coulomb failure theory **2.4** Effective stress principle **2.5** Determination of shear parameters by direct shear	**i.** Compare and contrast different methods for determining shear strength parameters. **ii.** Research the factors affecting the shear strength of soil.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Analyze the results of a direct shear test and determine the shear strength parameters of a soil.
- **ii.** Construct a Mohr circle diagram for a soil sample under different loading conditions.

b. Mini Project:

- **i.** Design and build a miniature shear testing apparatus using readily available materials.

c. Other Activities (Specify):

- **i.** Create a video tutorial explaining the principles of Mohr circle diagrams.

AE 305.3: Compaction of Soils and Field Methods

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	5	2	2	2	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Describe the composition of soils and its influence on compaction behavior. **SO3.2** Perform standard and modified Proctor tests, understand Abbot compaction and Jodhpur mini compaction tests. **SO3.3** Determine optimum moisture content and maximum dry density of soils using laboratory and field methods. **SO3.4** Implement quality control procedures to achieve desired compaction in the field.	**i.** Determination of compaction properties by standard proctor test.	**Unit-3:Compaction of Soils** **3.1** Compaction composition of soils, and **3.2** Standard protector test **3.3** Modified protector test **3.4** Abbot compaction **3.5** Jodhpur mini compaction test	**i.** Research the different types of compaction equipment and their applications. **ii.** Explore the factors affecting the compaction characteristics of soil.

SW-3 Suggested Sessional Work(SW):

a. **Assignments:**
   - **i.** Analyze the results of a standard Proctor compaction test and determine the maximum dry density and optimum moisture content of a soil.
   - **ii.** Explain the importance of proper compaction in soil engineering.

b. **Mini Project:**
   - **i.** Create a poster illustrating the benefits of proper soil compaction in construction.

c. **Other Activities (Specify):**
   - **i.** Design and build a miniature compaction apparatus using a plastic bottle and soil.

AE 305.4: Consolidation of Soils and Settlement Analysis
Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	6	2	2	2	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Define and explain the process of consolidation in soils. **SO4.2** Apply Terzaghi's theory of one-dimensional consolidation to calculate settlement and time rate of consolidation. **SO4.3** Perform and interpret results of laboratory consolidation tests. **SO4.4** Calculate void ratio and coefficient of volume change, and determine the coefficient of consolidation using Taylor's and Casagrande's methods.	**i.** Determination of consolidation properties of soils.	**Unit-4: Consolidation of Soils** **4.1** Consolidation of soil **4.2** One dimentional consolidation spring analogy **4.3** Terzaghi's theory **4.4** Calculation of voids ratio and coefficient of volume change **4.5** Tylor's method **4.6** Determination of coefficient of consolidation	**i.** Research the different methods for determining the coefficient of consolidation. **ii.** Explore the factors affecting the consolidation rate of soil.

SW-4 Suggested Sessional Work(SW):

a. Assignments:

i. Analyze the results of a consolidation test and determine the coefficient of consolidation of a soil.

ii. Calculate the settlement of a foundation due to soil consolidation.

iii. Explain the importance of consolidation in foundation design.

b. Mini Project:

i. Design and build a simple apparatus to demonstrate the concept of soil consolidation.

c. Other Activities (Specify):

i. Create a video animation explaining the process of soil consolidation

AE 305.5: Earth Pressure and Slope Stability Analysis
Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	7	0	2	2	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Explain the concept of plastic equilibrium in soils and its application in earth pressure analysis. **SO5.2** Differentiate between active and passive earth pressure states and apply Rankine's theory to calculate earth pressure for cohesion less soils. **SO5.3** Perform stability analysis of slopes using the friction circle method and Taylor's stability number. **SO5.4** Solve numerical problems related to earth pressure and slope stability.		**Unit5:Earth Pressure and Slope Stability** **5.1** Earth pressure. **5.2** Plastic equilibrium in soils **5.3** Active and Passive states **5.4** Rankine' s theory of earth pressure **5.5** Stability of slopes and Infinite and finite slopes **5.6** Friction circles method **5.7** Taylor's stability number	**i.** Explore the factors affecting the stability of slopes. **ii.** Investigate the use of geotechnical reinforcement to improve slope stability

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Calculate the active and passive earth pressure exerted by a soil backfill on a retaining wall.
   ii. Analyze the stability of a simple slope using the friction circle method.
   iii. Explain the importance of slope stability in geotechnical engineering.

b. **Mini Project:**
   i. Design and build a model retaining wall to demonstrate the concept of earth pressure.

c. **Other Activities (Specify):**
   i. Create a presentation explaining the importance of slope stability in different engineering applications.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	(LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour(CL+ SW+SL)
AE 305.1: Introduction to Soil Mechanics and Stress Distribution	7	8	2	2	19
AE 305.2: Shear Strength and Laboratory Testing	5	6	2	2	15
AE 305.3: Compaction of Soils and Field Methods	5	2	2	2	11
AE 305.4: Consolidation of Soils and Settlement Analysis	6	2	2	2	12
AE 305.5:Earth Pressure and Slope Stability Analysis.	7	0	2	2	11
Total Hours	30	18	10	10	68

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction of Soil Mechanics	03	01	01	05
CO-2	Shear Strength of soils	02	06	02	10
CO-3	Compaction of soils	03	07	05	15
CO-4	Consolidation of soils	03	05	02	10
CO-5	Earth Pressure and Slope Stability	03	05	02	10
Total		14	24	12	50

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

The end of semester assessment for Soil 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Krishi Vigyan Kedra
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog, Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Fundamentals Soil Mechanics	B.C. Punamia	Laxmi Publication	2005
2	Soil Mechanics and Foundation Engineering	K.R Arora	Standard Publishers and Distributors, New Delhi.	2000
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

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Cos , Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering
Course Code: 22CE325
Course Title: Soil Mechanics

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1: Introduction to Soil Mechanics and Stress Distribution.	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO 2: Shear Strength and Laboratory Testing.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO3: Compaction of Soils and Field Methods.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO 4: Consolidation of Soils and Settlement Analysis.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO 5: Earth Pressure and Slope Stability Analysis.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-1:Introduction to Soil Mechanics and Stress Distribution.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	4	Unit-1.0Introduction to Soil Mechanics 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	**As Mentioned along with the concern units**
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 2:Shear Strength and Laboratory Testing.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	3	Unit-2Shear Strength 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO3: Compaction of Soils and Field Methods.	SO3.1 SO3.2 SO3.3 SO3.4	1	Unit-3:Compaction of Soils 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 4: Consolidation of Soils and Settlement Analysis.	SO4.1 SO4.2 SO4.3 SO4.4	1	Unit-4:Consolidation of Soils 4.1,4.2,4.3,4.4,4.5,4.6,4.7	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 5: Earth Pressure and Slope Stability Analysis.	SO5.1 SO5.2 SO5.3 SO5.4	0	Unit5:Earth Pressure and Slope Stability 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code: 22CE326

Course Title: Theory of Structures.

Pre-requisite: Student should have basic knowledge of, fundamental of structural analysis, engineering mechanics, material science & mathematics.

Rationale: The study of the theory of structures is fundamentally important in the field of civil engineering for several compelling reasons. Course covering loads and the use of BIS codes, design of connections, design of structural steel members in tension, compression, and bending, design of steel roof trusses, and analysis and design of various reinforced concrete sections, including shear, bond, and torsion, as well as flanged beams, slabs, columns, foundations, retaining walls, and silos, is to equip students with comprehensive knowledge and practical skills in structural engineering. Understanding and applying the BIS codes ensures adherence to national standards, promoting safety and reliability in construction. Mastery of these topics enables future engineers to design and analyze a wide range of structural elements, ensuring their competence in creating safe, efficient, and sustainable structures that meet industry standards and client requirements.

Course Outcomes:

AE 306.1: Understand the basic concept of design and various loads and BIS codes and design the riveted, bolted and welded joints.

AE 306.2: Understand the basic concept of designing steel structural elements and design various tension and compression members.

AE 306.3: Design of flexural members i.e. beams and plate girders and steel roof truss.

AE 306.4: Understand the design concept of singly and doubly reinforced beam section for flexure, shear, bond and torsion.

AE 306.5: Understand the design concept of flanged sections, slabs, columns, foundations, retaining walls and silos.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Engineering Science Course (ESC)	**22CE326**	**Theory Of Structure**	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ESC	**22CE326**	**Theory Of Structure (Theory)**	0	15	15	0	0	30	50	80
		Theory Of Structure (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 306.1: Understand the basic concept of designing steel structural elements and design the riveted, bolted and welded joints.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1 Introduction to steel, various forms, properties and uses. **SO1.2**Different types of connections. **SO1.3**Design of welded, bolted and riveted connections. **SO1.4**Concentric and eccentric connections. **SO1.5** Classification of various steel sections. .	1. Design and drawing of bolted connections. 2. Design and drawing of riveted connections. 3. Design and drawing of welded connections.	**Unit-1.0 Loads and use of BIS codes. Design of connections.** 1.1 Introduction; Metallurgy of steel; Structural properties of steel; 1.2 Design philosophies; Limit state method; Partial load factors; Loading and load combination on structures. 1.3 Various Structural design theories. 1.4 Connections and its types. 1.5 Design of bolted and riveted connections. 1.6 Design of welded connections.	1. Know about the different assumptions made in the different theories of designing structures. 2. Evaluated the load carrying capacity of eccentric connections.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Connections, their types and load carrying capacity of various connections and their efficiencies.

b. **Mini Project:**

i. Prepare a chart representing all the rolled steel sections along with neat sketches and markings.

c. **Other Activities (Specify):**

Show the complete load transfer mechanism in a bolted/riveted connection and a welded connection. Also differentiate and give your comments.

AE 306.2: Understand the basic concept of designing steel structural elements and design various tension and compression members.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Tension members and their types. **SO2.2** Strength of tension members i.e. yielding, rupture and block shear. **SO2.3** Compression members and their types. **SO2.4** Concept of slenderness ratio. **SO2.5** Design strength of compression members.	1. Design and drawing of tension members. 2. Design and drawing of compression members. 3. Design and drawing of different column sections.	**Unit-2 Design of structural steel members in tension, compression and bending.** 2.1 Types of tension member. 2.2 Design of tension member; for yielding; Net section rupture; Block shear. 2.3 Types of compression members. 2.4 Slenderness ratio and basis of current codal provision for compression member design. 2.5 Strength curves. 2.6 Design of compression members.	i. Enlist various coal provisions for design of tension and compression members. ii. Evaluate the strength of a column with lacings and battens.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
Differentiate between short, intermediate and long columns and evaluate their strengths in bucking.

b. **Mini Project:**
Prepare a chart representing various tension and compression members with proper labeling and mention each and every part on it.

c. **Other Activities (Specify):**
Collect pictures of various tension and compression members in a truss system and also prepare a neat and clean chart with those pictures representing each.

AE 306.3: Design flexural members i.e. beams and plate girders and steel roof truss.
Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Introduction to beams and its types **SO3.2** Design criteria of beams. **SO3.3** Introduction to plate girders, its parts and design criteria. **SO3.4** Stiffeners and its types. **SO3.5** Design of beam column connections.	1. Design and drawing of various beam sections. 2. Design and drawing of plate girders. 3. Design and drawing of gantry girders.	**Unit-3:Design of Flexural Members.** 3.1 Introduction to Beam and its types. 3.2 Design strength of Laterally supported and Unsupported beams in bending. 3.3 Design of beams; Built-up beams 3.4 Design of plate girders. 3.5 Types of stiffeners; Flange and web splices. 3.6 Design of beam-columns subjected to combined tension and bending.	i. Different cross sections of beams. ii. Assumptions and mechanisms involved in design of beams.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Properly differentiate between beam and plate girders.
ii. Mention all the parts of a plate girder with neat sketches to support your answer.
iii. Mention all the design steps for designing a plate girder.

b. Mini Project:

Enlist all the types of stiffeners and their uses. Support your answer with neat sketches.

c. Other Activities (Specify):

A hands-on project to design and build a small-scale model of a plate girder bridge.

AE 306.4: Understand the design concept of singly and doubly reinforced beam section for flexure, shear, bond and torsion.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Introduction and assumptions involved in the reinforced sections design. **SO4.2**Design of singly reinforced sections. **SO4.3**Design of doubly reinforced section. **SO4.4**Design the sections for shear and bond. **SO4.5** Design the beam subjected to both bending and torsion.	1. Design and drawing of various RCC beam sections. 2. Design and drawing of Double reinforced sections. 3. Design and drawing of Flanged beam sections.	**Unit-4Analysis and design of singly and doubly reinforced sections, shear, bond and torsion.** 4.1. Introduction to RCC and various assumptions involved in the design of reinforced sections. 4.2. Design of singly reinforced sections. 4.3. Concept of doubly reinforced sections. 4.4. Design of doubly reinforced sections. 4.5. Concept for check of the section for shear and bond. 4.6. Concept of torsion and design of beams for bending and torsion combined.	i. Enlist all the important codal provisions required in designing beams for bending, shear, bond and torsion. ii. Know about various types of flanged beam sections i.e. T-beams and L-beams.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Draw a typical section of a singly and a doubly reinforced beam sections and also differentiate between the two.

ii. Discuss all the assumptions made in the design considerations of singly and doubly reinforced beams.

b. Mini Project:

c. A hands-on project to design and build a small scale model of a simply supported beam.

d. Other Activities (Specify):

Prepare a poster showing various strain and stress diagrams in the under reinforced , balanced and over reinforced beams.

AE 306.5: Understand the design concept of flanged sections, slabs, columns, foundations, retaining walls and silos.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Introduction to industrial buildings. **SO5.2** Various types of trusses. **SO5.3** Design of truss systems. **SO5.4** Gantry girders and all its parts **SO5.5** Design of gantry girder.	1. Design and drawing of various RCC slab sections. 2. Design and drawing of various column sections. 3. Design and drawing of different footing sections.	**Unit 5: Design of slabs, columns, foundations, retaining walls and silos.** 5.1. Various design considerations of slab design. 5.2. Design of slabs. 5.3. Design of column sections. 5.4. Design of different types of footings. 5.5. Design of retaining walls. 5.6. Design of storage bunkers and silos.	1. Understand various types of slabs and footings 2. Know all the differences between a bunker and a silo.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**

List the different types of footings along with neat sketches.

Enlist all the important codal provisions included in the design of a column and a footing.

b. **Mini Project:**

Prepare a poster depicting all the different types of slabs and properly differentiate between them i.e. one way and two-way slab.

c. **Other Activities (Specify):**

A hands-on project to design and build a small-scale model of a frame showing beam-column-footing connection.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instructions (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
AE 306.1: Understand the basic concept of designing steel structural elements and design the riveted, bolted and welded joints.	06	06	2	1	15
AE 306.2: Understand the basic concept of designing steel structural elements and design various tension and compression members.	06	06	2	1	15
AE 306.3: Design flexural members i.e. beams and plate girders and steel roof truss.	06	06	2	1	15
AE 306.4: Understand the design concept of singly and doubly reinforced beam section for flexure, shear, bond and torsion.	06	06	2	1	15
AE 306.5: Understand the design concept of flanged sections, slabs, columns, foundations, retaining walls and silos.	06	06	2	1	15
Total Hours	30	30	10	5	75

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Loads and use of BIS codes. Design of connections.**	03	01	01	05
CO-2	**Design of structural steel members in tension, compression and bending.**	02	06	02	10
CO-3	**Design of Flexural Members.**	03	07	05	15
CO-4	**Analysis and design of singly and doubly reinforced sections, shear, bond and torsion.**	-	10	05	15
CO-5	**Design of slabs, columns, foundations, retaining walls and silos.**	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for theory of structures. 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to various Constructional 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	Fundamentals of Structural Steel Design	Gambhir M. L	McGraw Hill Education	First edition, 2017.
2	Design of Steel Structures	Dayaratnam P	A. H. Wheeler & Co. Ltd, Allahabad	2008
3	Design of Steel Structures	Arya and Ajmani	NemChand Brothers, Roorkee	2007
4	Plain & Reinforced Concrete Vol. I & II	O.P. Jain & Jay Krishna		

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22CE326

Course Title: Theory of Structure

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Understand the basic concept of designing steel structural elements and design the riveted, bolted and welded joints.	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO-2 Understand the basic concept of designing steel structural elements and design various tension and compression members.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO-3 Design flexural members i.e. beams and plate girders and steel roof truss.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Understand the design concept of singly and doubly reinforced beam section for flexure, shear, bond and torsion.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 Understand the design concept of flanged sections, slabs, columns, foundations, retaining walls and silos.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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** Understand the basic concept of designing steel structural elements and design the riveted, bolted and welded joints.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	**As Mentioned along with the concern units**	AE 306.1 **Loads and use of BIS codes. Design of connections.** 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-2** Understand the basic concept of designing steel structural elements and design various tension and compression members.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 306.2 Design of structural steel members in tension, compression and bending. 2.1,2.2,2 .3,1.4,1.5,1.6	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-3** Design flexural members i.e. beams and plate girders and steel roof truss.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 306.3 **Designs of Flexural Members.** 3.1,3.2,2 .3,1.4,1.5,1.6	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-4** Understand the design concept of singly and doubly reinforced beam section for flexure, shear, bond and torsion.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 306.4 **Analysis and design of singly and doubly reinforced sections, shear, bond and torsion.** 4.1,3.4,2 .3,4.4,4.5,4.6	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-5** Understand the design concept of flanged sections, slabs, columns, foundations, retaining walls and silos.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 306.5 **Design of slabs, columns, foundations, retaining walls and silos.** 5.1,3.5,5 .3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code: **22ME327**

Course Title: **MACHINE DESIGN**

Pre-requisite: Students should have prior understanding of engineering mechanics, materials science, and basic mathematics is required. Familiarity with concepts such as stress, strain, material properties, and equilibrium equations is essential for comprehending and applying the principles of machine design effectively.

Rationale Machine Design imparts fundamental skills to design mechanical systems. It integrates engineering sciences, fosters hands-on learning, emphasizes optimization, and prepares students for professional practice. By mastering design principles, students innovate and contribute to various industries, ensuring readiness for the complexities of modern engineering challenges.

Course Outcomes:

AE 307.1: Apply fundamental principles to design mechanical components considering material properties and design considerations.

AE 307.2: Analyze different types of loads and stresses, determining appropriate factors of safety for design selections.

AE 307.3: Design various mechanical joints and connections, including threaded fasteners, welded connections, and mechanical couplings.

AE 307.4: Evaluate the performance of power transmission elements like belts, gears, and screw motion mechanisms in mechanical design.

AE 307.5: Select and apply suitable anti-friction bearings for machine design applications, considering load and speed requirements.

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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)	
ESC	**22ME327**	**MACHINE DESIGN**	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:

Theory

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
ESC	**22ME327**	**MACHINE DESIGN**	10	15	15	5	5	50	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.

AE 307.1: Apply fundamental principles to design mechanical components considering material properties and design considerations.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Define design phases and considerations in engineering. **SO1.2**Identify common engineering materials and their mechanical properties. **SO1.3**Recognize types of loads, stresses, and theories of failure. **SO1.4**Calculate factor of safety and select allowable stress. **SO1.5**Understand stress concentration effects in mechanical design. .		1.1 Meaning of design, Phases of design, 1.2 Design considerations. 1.3 Common engineering materials and their mechanical properties. 1.4 Types of loads and stresses, 1.5 Theories of failure, factor of safety, 1.6 Selection of allowable stress. Stress concentration.	1. Stress and Strain Basics 2.failure mechanisms

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Discuss how design considerations influence the final product or structure

b. MiniProject:

i. Plot stress-strain curves mild steel.

AE 307.2: Analyze different types of loads and stresses, determining appropriate factors of safety for design selections.

Approximate Hours

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (S)**
SO2.1 Understand elementary fatigue and creep phenomena in materials. **SO2.2** Analyze the functionality and applications of cotter, knuckle, and pinned joints. **SO2.3** Design welded joints to withstand static loads effectively. **SO2.4** Apply principles to mitigate fatigue and creep effects in design. **SO2.5** Evaluate turnbuckle functionality and its application in mechanical systems.		2.1 Elementary fatigue and creep aspects. 2.2 Cotter joints. 2.3 Numerical Solving 2.4 knuckle joint and pinned joints 2.5Numerical Solving and turnbuckle. 2.6 Design of welded subjected to static loads. .	1. Exploring failure analysis in welded structures.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**

i. Compare and contrast cotter joints and knuckle joints in mechanical design applications

b. **Mini Project:**

i. Draw neat and clean sketch of cotter and knuckle joint

c. **Other Activities (Specify):**

i. Collect the images of engine components and paste in a file.

AE 307.3: Design various mechanical joints and connections, including threaded fasteners, welded connections, and mechanical couplings.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Design threaded fasteners to withstand direct static loads effectively. **SO3.2** Analyze bolted joints under shear loading for optimal design. **SO3.3**Evaluate bolted joints under eccentric loading for efficient design. **SO3.4** Apply principles of bolted joint design to real-world engineering scenarios. **SO3.5** Demonstrate proficiency in selecting and specifying appropriate fastening methods for specific mechanical applications.		3.1 Design of threaded fasteners subjected to direct static loads 3.2 Numerical solving 3.3 Bolted joints loaded in shear 3.4 Numerical solving 3.5 Bolted joints subjected to eccentric loading 3.6 Numerical Solving	1.Factors Affecting Bolted Joint Performance

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Evaluate the advantages and limitations of bolted joints compared to other fastening methods, such as welding and adhesives.

b. Mini Project:

i. Design and conduct an experiment to analyze torque-load relationship in threaded fasteners. Discuss findings.

AE 307.4: Evaluate the performance of power transmission elements like belts, gears, and screw motion mechanisms in mechanical design.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (S)
SO4.1 Design shafts to withstand torsional and combined bending-torsional loads. **SO4.2** Analyze and design keys for efficient power transmission in mechanical systems. **SO4.3** Design muff, sleeve, and rigid flange couplings for effective torque transmission. **SO4.4** Design helical and leaf springs to meet specified mechanical requirements. **SO4.5** Apply principles of shaft and coupling design to solve engineering problems effectively		4.1 Design of shafts under torsion 4.2Design of shafts under combined bending and torsion. 4.3 Numerical Solving 4.4 Design of keys. 4.5 Design of muff, sleeve, and rigid flange couplings. 4.6 Design of helical and leaf springs.	1. Real-world Applications of Springs in Engineering

SW-4 Suggested Sessional Work SW):

a. Assignments:

i. Design and analyze shafts under torsion and combined loading, keys, couplings, and springs. Present findings."

b. Mini Project:

i. Design and test mechanical components like shafts, keys, couplings, and springs. Analyze performance and findings.

AE 307.5: Select and apply suitable anti-friction bearings for machine design applications, considering load and speed requirements.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (S)**
SO5.1 Design flat belt and V-belt drives and pulleys for efficient power transmission. **SO5.2** Analyze gear systems and design gears for various mechanical applications. **SO5.3**Design screw motion mechanisms such as screw jacks and lead screws for linear motion. **SO5.4** Select anti-friction bearings based on load, speed, and application requirements. **SO5.5** Apply principles of belt and gear design to optimize mechanical systems for performance and reliability.		5.1 Design of flat belt 5.2V-belt drives and pulleys. 5.3 Design of gears. 5.4 Design of screw motion mechanisms like screw jack, lead screw, etc. 5.5 Numerical solving 5.6 Selection of anti-friction bearings.	1. Fundamentals of gear design

SW-4Suggested Sessional Work (SW):

a) **Assignments:**
i. Write down the nomenclature of Gear with well labeled diagram.

a. **Mini Project**:
i. Design analysis of screw jack.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour(CL +LI+SW +SL)
AE 307.1: Apply fundamental principles to design mechanical components considering material properties and design considerations.	6	0	1	1	8
AE 307.2: Analyze different types of loads and stresses, determining appropriate factors of safety for design selections.	6	0	1	1	8
AE 307.3: Design various mechanical joints and connections, including threaded fasteners, welded connections, and mechanical couplings.	6	0	1	1	8
AE 307.4: Evaluate the performance of power transmission elements like belts, gears, and screw motion mechanisms in mechanical design.	6	0	2	1	9
AE 307.5: Select and apply suitableanti-friction bearings for machine design applications, considering load and speed requirements.	6	0	2	2	10
Total Hours	30	0	7	6	43

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

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CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Fundamentals of Mechanical Design	02	05	03	10
CO-2	Mechanical Joints and Welded Connections	02	05	03	10
CO-3	Fasteners and Bolted Joints Design	03	07	05	15
CO-4	Shaft and Coupling Design	03	07	05	15
CO-5	Power Transmission Elements				
Total		10	24	16	50

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

The end of semester assessment for machine 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 canal so 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. Demonstration
7. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog, Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
8. Brainstorm

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	A Textbook of Design of Machine Elements	B. Bandari	Tata McGraw hill	Third Edition 2011
2	Machine Design	P. Kannaiah	SciTech Publications India Pvt. Ltd, New Delhi	2014
3.	Machine Design	R. S. Khurmi, A. K. Gupta	S. Chand & Co, New Delhi,	1st edition, 2014
4	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering

Course Code: 22ME327

Course Title: MACHINE DESIGN

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Apply fundamental principles to design mechanical components considering material properties and design considerations	2	2	2	2	2	2	3	1	1	1	1	1	2	3	3	2
CO 2: Analyze different types of loads and stresses, determining appropriate factors of safety for design selections.	3	2	2	3	3	2	2	1	2	1	1	1	2	3	2	2
CO3: Design various mechanical joints and connections, including threaded fasteners, welded connections, and mechanical couplings.	3	3	2	2	2	2	2	1	1	2	1	1	1	2	3	2
CO4: Evaluate the performance of power transmission elements like belts, gears, and screw motion mechanismsin mechanical design.	3	3	2	3	2	2	2	1	2	2	1	1	3	3	3	2
CO5: Select and apply suitable anti-friction bearings for machine design applications, considering load and speed requirements.	3	3	2	3	2	2	2	1	1	1	1	1		3	2	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)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-1: Apply fundamental principles to design mechanical components considering material properties and design considerations.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		**Unit-1.0 Fundamentals of Mechanical Design** 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-2: Analyze different types of loads and stresses, determining appropriate factors of safety for design selections.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		**Unit-2Mechanical Joints and Welded Connections** 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-3: Design various mechanical joints and connections, including threaded fasteners, welded connections, and mechanical couplings.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		**Unit-3 : Fasteners and Bolted Joints Design** 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-4: Evaluate the performance of power transmission elements like belts, gears, and screw motion mechanisms in mechanical design.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		**Unit-4:Shaft and Coupling Design** 4.1,4.2, 4.3, 4.4, 4.5,4.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-5 Select and apply suitable anti-friction bearings for machine design applications, considering load and speed requirements.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		**Unit-5: Power Transmission Elements** 5.1,5.2, 5.3, 5.4, 5.5,5.6	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code: **22ME328**

Course Title: **HEAT & MASS TRANSFER**

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 mechanisms.

Course Outcomes:

AE 308.1: Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.

AE 308.2: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.

AE 308.3: Discuss mechanism and various laws associated with Thermal radiation. Find out shape factors for the various geometries and evaluate the rate of heat exchange between them.

AE 308.4: 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.

AE 308.5: Define, classify and analyze the Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Engineering Science (ESC)	22ME328	Heat & Mass Transfer	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:

Theory

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+ AT)		
Engineering Sciences (ECS)	22ME328	Heat & Mass Transfer	10	15	15	5	5	50	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.

AE 308.1: Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.

Approximate Hours

Item	**Cl**	**LI**	**SW**	**SL**	**Total**
Appx. Hrs.	**6**	**0**	**1**	**1**	**8**

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**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.	.	**Unit-1: Heat Transfer By Conduction** 1.1 General concepts of heat transfer by conduction, convection and radiation. 1.2 Fourier’s Law and Electrical analogy of thermal systems. 1.3 one dimensional (1D) conduction without heat generation through plain walls, cylindrical & spherical surfaces. 1.4 Critical thickness of insulation for cylinder & sphere & introduction to fins. 1.5 Numerical problems on composite plain walls. 1.6 Numerical problems on composite cylindrical walls.	1. Numerical problems based on critical radius of insulation for cylinders and spheres. 2. Numerical problem solving on composite slabs using electrical analogy and Fourier’s Law.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Derivation of general conduction equation in 3D for cylindrical & spherical surfaces.

ii. Numerical on one dimensional conduction with and without heat generation

b. **Mini Project:**

List down various thermal insulating materials used in thermal power plants and refrigeration and air conditioning applications.

AE 308.2: Explanation and analysis of heat transfer by forced and natural convection.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 The students will be able to understand the mechanisms of forced and natural convection. **SO3.2** The students will be able to apply the empirical equation for calculation of heat transfer through natural convection. **SO3.3** The students will be able to apply the empirical equation for calculation of heat transfer through forced convection.	.	**Unit-2: Forced and Natural convection.** 2.1 Physical Mechanism of Forced and Free convection 2.2 Velocity and Thermal Boundary layers. 2.3 Empirical relationship for forced convection 2.4 Empirical relationship for natural convection. 2.5 Combined free and forced convection. 2.6 Numerical problems.	1. Understanding Dimensionless numbers. 2. Study the Boundary layer theory.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Problem based on heat transfer for natural convection over flat plate.

b. Mini Project:

Write down all the heat transfer correlations for forced and natural convective heat transfer problem also list down the formulae of all the dimensionless numbers involved.

AE 308.3: Explanation and analysis of Thermal Radiation.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understanding basic definitions. **SO5.2**Evaluate the Radiative heat exchange. **SO5.3**To determine the Emissive power		**Unit3: Thermal Radiation** 3.1 Black body radiation: Absorptivity, reflectivity & Transmissivity Kirchhoff's law. 3.2 Shape factor and it's features. 3.3 Plank's experiment, Stefan Boltzmann & Wein's equations. 3.4 Radiant heat exchange between parallel surfaces, long concentric cylinders, small gray bodies. 3.5 Radiation shields. 3.6 Numerical problems.	• Electrical analogy to thermal radiation.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

Explain Errors in temperature measurement due to radiation.

Mini Project:

Explain non-luminous gas radiation.

AE 308.4: Explanation and analysis of heat exchangers.
Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 Analyzing& Solving Problems on heat exchangers. **SO4.2** Design the heat exchangers.	.	**Unit-4: Heat Exchangers.** 4.1.Classification of heat exchangers. 4.2 LMTD analysis of parallel and counter flow heat exchangers. 4.3. NTU analysis of parallel and counter flow heat exchangers. 4.4. Effectiveness and efficiency of heat exchangers. 4.5. Numerical problems on LMTD 4.6 Numerical problems on NTU approach.	1. Analyze the cross-flow heat exchanger. 2.Problems on cross flow heat exchangers.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems on Heat exchangers

b. Mini Project:

i. Make a chart classifying various heat exchangers with the help of neat sketches.

AE 308.5: Explanation and analysis of mass transfer.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Analyzing& Solving Problems on heat exchangers. **SO4.** Design the heat exchangers.	.	**Unit-4: Mass transfer.** 5.1. Steady state molecular diffusion in fluids at rest and in laminar flow. 5.2 Fick's law. 5.3. Mass transfer coefficients. 5.4. Reynold's analogy. 5.5 Numerical problems on laminar molecular diffusion. 5.6 Numerical problems on Reynold's analogy.	1. Problems on mass transfer.

SW-5 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems on Fick's law.

b. Mini Project:

i. Make a chart classifying various mass transfer methods with the help of neat sketches

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+SW+SL)
AE 308.1: Explain different modes of heat transfer and Calculate heat transfer for one-dimensional steady state conduction in solids.	6	1	1	8
AE 308.2: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection	6	1	1	8
AE 308.3: Discuss mechanism and various laws of Thermal radiation. Find out shape factors and evaluate the rate of heat exchange.	6	1	1	8
AE 308.4: Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers.	6	1	1	8
AE 308.5: Define, classify and analyze the Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients	6	1	1	8
Total Hours	30	5	5	40

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	02	05	05	12
CO-2	FORCED AND FREE CONVECTION	02	03	03	8
CO-3	HEAT EXCHANGERS.	02	05	05	12
CO-4	Heat Transfer by Radiation	02	04	04	10
CO-5	MASS TRANSFER	01	04	03	08
Total		9	21	20	50

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

The end of semester assessment for heat & 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Roleplay
6. Visit to cement plant
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	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
4	Lecture note provided by Dept. of Agriculture engineering, AKS University, Satna.			

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering

Course Code: 22ME327

Course Title: MACHINE DESIGN

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1: Explain different modes of heat transfer and Calculate heat transfer for 1-D steady state conduction in solids.	2	1	2	2	3	2	2	2	2	1	3	2	2	2	1	2
CO-2: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.	1	1	1	1	3	2	2	2	2	1	2	2	1	2	1	2
CO-3: Discuss mechanism and various laws associated with Thermal radiation. Find out shape factors for the various geometries and evaluate the rate of heat exchange between them	2	2	1	1	3	1	2	2	2	1	1	2	1	2	1	1
CO-4:2 Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers.	2	2	2	1	3	2	2	2	2	1	2	2	1	2	1	2
CO-5: classify and analyze the Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients	2	1	1	1	1	3	2	2	2	1	2	2	1	2	1	1

Legend:1–Low,2–Medium,3–High

Course Curriculum Map:

Pos &PSOs No.	Cos No. & Titles	SOs No.	Classroom Instruction (CI)	Self Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-1: Explain different modes of heat transfer and Calculate heat transfer for 1-D steady state conduction in solids.	SO1.1 SO1.2	Unit-1.0: Introduction to heat transfer, General concepts of heat transfer by conduction, convection and radiation.	**As Mentioned along with the concern units**
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 2: Discuss various correlations of natural and forced convection, Explain and solve heat transfer problems in forced and natural convection.	SO2.1 SO2.2	Unit-2: Classification of convective heat transfer process and analysis of it's types.	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO3: Discuss mechanism and various laws associated with Thermal radiation. Find out shape factors for the various geometries and evaluate the rate of heat exchange between them.	SO3.1 SO3.2 SO3.3	Unit-3: Mechanism and various laws associated with mass transfer. Thermal radiation. 3.1,3.2,3.3	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 4: Define, classify and analyze the performance of heat exchanges such as parallel flow, counter flow and cross flow heat exchangers. Discuss various boiling & condensation regimes.	SO4.1	Unit-4**:** Classification and Analysis of different types of heat exchangers. 4.1,4.2,4.3	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 5: classify and analyze the Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients	SO5.1 SO5.2	Unit5**:** Mechanism and various laws associated with mass transfer. 5.1,5.2,5.3	

AKS UNIVERSITY, SATNA
Faculty of Agriculture Science and Technology
Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-III

Course Code:	**22EE329**
Course Title:	**Electrical Machines and Power Utilization**
Pre-requisite:	Students should have basic knowledge of electrostatics & electromagnetic Physics, and Mathematics.
Rationale:	A process of introducing formal knowledge of basic principles of machine, construction, and working various transformers, D.C. machines, Induction machines, and Single-Phase machines with measurement of AC circuits, and connections.

Course Outcomes:

AE309.1: Understand the fundamental knowledge of basic principles of machines.

AE309.2: Understand the principle, working, and tests of a Single-Phase transformer.

AE309.3: Understand the principle, working, and performance characteristics of DC machines (generator, and motor). Tests associated with DC machines.

AE309.4: Understand the starting and speed control of the DC motor with the necessary knowledge of the three-phase Induction machine and single-phase Induction machine.

AE309.5: Analyse the principle and working of various single-phase motors, measurement of three-phase power, and different types of connections of AC circuits.

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)	
Engineering Science courses (ESC)	22EE329	Electrical Machine-1	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 must be planned and performed under the teacher's continuous guidance and feedback to ensure the Learning outcome.

Scheme of Assessment:
Theory& Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
ESC	22EE329	**Electrical Machines and Power Utilization (Theory)**	0	15	15	0	0	30	50	80
		Electrical Machines and Power Utilization (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE309.1: Basic principles of machines.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	8	0	2	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Attain the basic knowledge about flux, flux density, and magnetic field intensity. **SO1.2** Understand the concept of reluctance andelectro-motive force in magnetic circuits. **SO1.3** Understand and derive the laws of magnetic circuits. **SO1.4** Determination of ampere-turns for series and parallel magnetic circuits. **SO1.5** Understand the hysteresis and eddy current losses. .		**Unit-1: Basic Principles of Machines.** 1.1 Flux 1.2 Flux Density 1.3 Magnetic Field Intensity 1.4 Reluctance 1.5 Electro-Motive Force 1.6 Laws of Magnetic Circuit. 1.7 Determination of Ampere-Turns for Series, and Parallel Magnetic Circuit 1.8 Hysteresis, and Eddy Current Losses	1. Understand the Basic Principles of Machines.

SW-1 Suggested Sessional Work(SW):

a. Assignments:

i. Solve Numerical based on the Laws of Magnetic Circuits.

b. Mini Project:

i. Draw the basic diagrams of various systems with theory.

AE 309.2: Transformers.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx.Hrs	**7**	**6**	**2**	**1**	**16**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 To Understand the Basic Construction and Working Principle of Single-Phase Transformers. **SO2.2** Derive the EMF equation of the transformer. **SO2.3**Draw the Phasor Diagram on different loads. **SO2.4** To understand the concept of leakage reactance. **SO2.5** define the voltage regulation. **SO2.6** defines power and energy efficiency. **SO2.7** Understand the O.C. and S.C. Test.	1. Study the constructional details of transformers. 2. To perform open circuit test on transformer. 3. To perform Short Circuit test on transformer.	**Unit-02: Transformers** 2.1 Construction and Working Principle 2.2EMF Equation 2.3 Leakage Reactance 2.4 voltage Regulation 2.5 Power & Energy Efficiency 2.6 Open Circuit Test 2.7 Short Circuit Test	1. Learn and gain knowledge of Transformer.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Numerical Problems based on Transformer's EMF Equations.
   ii. Numerical Problems of Voltage Regulation.
   iii. Numerical Problems of Open Circuit, and Short Circuit Test.

b. **Mini Project:**

i. Draw the phasor diagram of the Transformer.

AE 309.3: D.C. Machines.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	7	8	2	1	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 To Understand thePrinciple, Operation, and Performance Characteristics of DC Machines. **SO2.2** Derive the EMF and Torque equation. **SO3.3** To Understand the Armature Reaction. **SO3.4**To Understand the Commutation Process. **SO3.5** To Analyze the performance characteristics of the DC machine.	1. To study the constructional features of DC machine. 2. To obtain magnetization characteristics of DC shunt generator. 3. To obtain load characteristics of DC shunt generator. 4. To obtain load characteristics of DC series generator.	**Unit-3:D.C. Machines** 3.1 Principle, and Operation 3.2 EMF, and Torque equation 3.3 Armature Reaction 3.4 Commutation Process 3.5 Excitation 3.6 Performance Characteristics of DC Generator 3.7 Performance Characteristics of DC Motor	1. To ensure all the concepts of DC Machines should be learned.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Numerical Problems on EMF, and Torque equations.
ii. Numerical Problems on Performance Characteristics.

AE 309.4: Starting, and control of DC Motor and Induction Machine.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	7	4	2	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 To understand the concept of starting of DC series and Shunt Motors. **SO4.2** To Understand the Working of Starters. **SO4.3** To Study the Speed Control Methods of DC Motors. **SO4.4** To Understand the Construction, and Operation of Induction Machine. **SO4.5** Draw the Phasor Diagram. **SO4.6** To Understand the effect of rotor resistance. **SO4.7** Derive the Torque Equation. **SO4.8** To Understand the Starting, and Speed Control Methods. **SO4.9** Study the Single-Phase Induction Machine.	1. Study the starting techniques of DC machines. 2. Study the different type of speed control methods of DC motors.	**Unit-4:Starting, and control of DC Motor and Induction Machine.** 4.1 Starting of DC Series, and Shunt Motors and Starters 4.2Speed Control Methods 4.3 Construction of Induction Machine 4.4Effect of Rotor Resistance 4.5 Torque Equation 4.6Starting of Induction Machine 4.7 Single-Phase Induction Machine	1. Make Well-Organized notes of DC Motors and the Induction Machine.

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Numerical Problems on Speed Control Methods of the DC Motors.
ii. Numerical Problems on EMF, and Torque Equation of Induction Machine.
iii. Numerical Problems on Speed Control Methods of the Induction Machine.

b. Mini Project:

i. Evaluate the Phasor Diagram of the induction Machine at different Loads.

AE 309.5: Single-Phase Machines and Different Connections.
Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	4	2	2	1	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 To Understand the Concept of Double Field Revolving Theory. **SO5.2** Draw the Equivalent Circuit. **SO5.3** To Study the Characteristics of Single-Phase Motors. **SO5.4** To Understand the Concept of Split-Phase and Shaded Pole Motors. **SO5.5** To Study the various methods of three-phase power measurements. **SO5.6** To study the Concept and Analysis of a Balanced Three-Phase System.	1. Study the double field revolving theory of single-phase Induction Machine.	**Unit 5: Single-Phase Machines and Different Connections.** 5.1 Double Field Revolving Theory 5.2 Shaded Pole Motor 5.3 various methods of three-phase power measurement: power factor, reactive and apparent power 5.4 Concept and analysis of balanced poly-phase circuits: Series and parallel resonance	1. To ensure Complete notes of the chapter related to the Single-Phase Motors.

SW-5 Suggested Sessional Work(SW):

a. Assignments:

i. Numerical Problem Based on Parallel Resonance.

b. Mini Project:

i. Draw the Equivalent Circuit of different types of Single-Phase Machines.

Brief of Hours Suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Lecture (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+LI+SW+SL)
AE 309.1: Understand the Basic Principles of the machine.	05	00	2	1	08
AE 309.2: Understand the Construction and Working of Transformer.	07	06	2	1	16
AE 309.3: Understand the Construction and working of DC Machine with a Study of Performance Characteristics.	07	08	2	1	18
AE 309.4: Understand the concept of DC Motors with Starters, Speed Control Methods, and Induction Machines Concepts.	07	04	2	2	14
AE 309.5: To Study the Single-Phase Motors and Various Connections.	04	02	2	1	09
Total Hours	30	20	12	6	68

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Basic Principles of Machine	03	01	01	05
CO-2	Transformer	02	06	02	10
CO-3	DC Machine	02	07	06	15
CO-4	DC Motor, and Induction Machine	03	07	05	15
CO-5	Single-Phase Motors, and Various Circuits	01	02	02	05
Total		11	23	16	50

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

The end of semester assessment for Process calculation will be held with the written examination of 50 marks.

Note. Detailed Assessment rubrics need to be prepared by the course-wise teachers for the above tasks. Teachers 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 the electrical power plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog ,Facebook,Twitter,WhatsApp,Mobile,Onlinesources)
9. Brainstorming

Suggested Learning Resources:

(a) **Books:**

S.No.	Title	Author	Publisher	Edition&Year
1	Electrical Machines	I.J. Nagrath & D.P.Kothari	Tata McGraw-Hill	Fourth-2018
2	Electrical Machines	Husain Ashfaq	Dhanpat Rai & Sons	Third-2016
3	Electrical Machinery	P.S.Bimbhra	Khanna Publisher	Seventh-2011
4	Electric Machinery	A.E. Fitzgerald, C.Kingsley Jr, and Umans	McGraw-Hill	Sixth-2002
5	Electric Machine and Transformers	Irving L., Kosow	Prentice Hall of India	Second-1991
6	The Performance and Design of AC machines	M.G. Say	Pitman& Sons	First-2005
7	A Text Book of Electrical Technology	B. L. Theraja	S. Chand & Company Ltd.	First-2005
8	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering Course Code: 22AE523

Course Title: Electrical Machines and Power Utilization

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Understand the Basic Principles of the machine.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-2 Understand the Construction and Working of Transformer.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO-3 Understand the Construction and working of DC Machine with a Study of Performance Characteristics.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Understand the concept of DC Motors with Starters, Speed Control Methods, and Induction Machines Concepts.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 To Study the Single-Phase Motors and Various Connections.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1

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** Understand the Basic Principles of the machine.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	**As Mentioned along with the concern units**	AE 309.1 Basic Principles of Machines.	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-2** Understand the Construction and Working of Transformer	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6 SO2.7		AE 309.2 Transformers	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-3** Understand the Construction and working of DC Machine with a Study of Performance Characteristics.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		AE 309.3 D.C. Machines	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-4** Understand the concept of DC Motors with Starters, Speed Control Methods, and Induction Machines Concepts.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6 SO4.7 SO4.8 SO4.9		AE 309.4 Starting and control of DC Motor and Induction Machine.	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-5** To Study the Single-Phase Motors and Various Connections.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5 SO5.6		AE 309.5 Single-Phase Machines and Different Connections.	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code:	22CE421
Course Title:	**Building Construction and Cost Estimation**
Pre-requisite:	Student should have basic understanding of mathematics, engineering principles and construction technology. In addition to this student should have basic knowledge of architectural design, building codes and cost estimation techniques too.
Rationale:	Studying building construction and cost estimation is essential for effectively managing construction projects, controlling costs, mitigating risks, promoting sustainability, and supporting economic development.

Course Outcomes:

AE 401.1: Understand the various engineering properties of different construction materials i.e. cement, concrete, steel etc.

AE 401.2: Understand the applications of different building components i.e. lintels, arches, stair cases etc. and also various types of engineering works included in the construction of a structure.

AE 401.3: Learn about different types of agricultural buildings, their applications and design theory.

AE 401.4: Understand the different types of estimates and factors affecting the costs of a building and cost analysis.

AE 401.5: Specify the different measurement and pricing techniques, calculating benefit to cost ratios and thus the feasibility of a project.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(ESC)	**22AN323**	**Building Cost and Cost Estimation**	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:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment (CA)	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
ESC	**22AEN323**	**Building Cost and Cost Estimation**	**10**	**15**	**15**	**5**	**5**	**50**	**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.

AE 401.1: Understand the various engineering properties of different construction materials i.e. cement, concrete, steel etc.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Introduction building materials. **SO1.2** Engineering properties of various building materials. **SO1.3** Rocks, Stones, Bricks, tiles . **SO1.4** Lime, cement, concrete, sand, glass. **SO1.**5 Rubber, plastics, Iron, steel and aluminum. .		**Unit-1.0 Building materials and their engineering properties.** 1.1 Introduction to various building materials. 1.2 Various engineering properties of Rocks and stones. 1.3 Various engineering properties of bricks, tiles and lime. 1.4 Various engineering properties of concrete, sand and glass.. 1.5 Various engineering properties of rubber and plastics. 1.6 Various engineering properties of iron and steel.	1. Properties of different types of building materials

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**

i. Different properties of steel, iron and aluminum.

b. **Mini Project:**

i. Stress strain graph if ductile and brittle materials and comparison between both.

c. **Other Activities (Specify):**

A flow chart representing all the processes involved in the manufacturing of timber used for building purposes.

AG 401.2: Understand the applications of different building components i.e. lintels, arches, stair cases etc. and also various types of engineering works included in the construction of a structure.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**SelfLearning (SL)**
SO2.1 Introduction to various building components. **SO2.2** building components like lintels, arches and stair cases. **SO2.3**Different types of floors **SO2.4** Damp proofing and water proofing. **SO2.5** Pointing, white washing and distempering..		**Unit-2 Different building components and engineering works.** 2.1 Introduction to various building components. 2.2 Lintel and arches. 2.3 Staircases. 2.4 Flooring and different types of floors. 2.5 Damp proofing and water proofing. 2.6 Plastering and pointing.	i. Enlist all the building components.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Enlist and sketch all the building components.
   ii. What is flooring and write about different types of flooring..

b. **Mini Project:**
   Prepare a graphical representation if a building showing all its major components along with their dimensions.

c. **Other Activities (Specify):**
   Presentation of a poster depicting the flooring and different types of flooring..

AG 401.3: Learn about different types of agricultural buildings, their applications and design theory.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	SelfLearning (SL)
SO3.1 Different types of buildings. **SO3.2** Building design procedures. **SO3.3** Building construction. **SO3.4** Types of agricultural buildings. **SO3.**5 Different types of roofing	.	**Unit-3 : Different types of agricultural buildings and their design procedures.** 3.1 Buildings and their types. 3.2 Design procedures for design different buildings. 3.3 Different types of agricultural buildings. 3.4 Various design procedures for designing agricultural buildings. 3.5 Various types of industrial buildings. 3.6 Various design theories and their applications.	i. Different types of buildings and their design procedures.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
Mentions the different design theories and differentiate between them.

b. **Mini Project:**
Prepare a comparison chart between different types of industrial buildings

c. **Other Activities (Specify):**
Comparison chart showing the difference between different types of roofs and roofing materials.

AG 401.4: Understand the different types of estimates and factors affecting the costs of a building and cost analysis.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	SelfLearning (SL)
SO4.1 Introduction of estimates. **SO4.2** Preliminary and detailed estimates **SO4.3** Use of cost analysis. **SO4.4** Factors affecting building costs. **SO4.5** Alternatives for building and estate development		**Unit-4 Construction economics.** 4.1 Introduction to estimates 4.2 Types of estimates. 4.3 Use of cost analysis for controlling design. 4.4 Factors affecting building costs 4.5 Cost evaluation of design and planning alternatives. 4.6 Building sources of cost estimation. .	i. Estimates and its different types.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Comparison between different types of estimates.

b. **Mini Project:**
   i. Comparison chart between different types of valuation.

c. **Other Activities (Specify):**
   Power Point Presentation on the various factors affecting the building costs.

AG 401.5: Specify the different measurement and pricing techniques, calculating benefit to cost ratios and thus the feasibility of a project.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	0	1	1	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	SelfLearning (SL)
SO5.1 Measurement and pricing. **SO5.2** Economical methods. **SO5.3** Benefits to cost ratio. **SO5.4** Saving to investments ratios **SO5.5** Rate of returns, net benefits..		**Unit 5: Measurement and pricing.** 5.1 Measurement and pricing. 5.2 Economics methods. 5.3 Methods for evaluating investments in buildings 5.4 Building systems. 5.5. Cost in use. 5.6 Benefits to cost and saving to investment ratios.	1.Undersatnd the different methods of valuation of a building.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

List the different types of valuation methods. .

b. Mini Project:

Prepare a poster depicting all the methods for evaluating investments in buildings and building systems.

c. Other Activities (Specify):

Graphical analysis of cost to benefit and saving to investment ratios

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instructions (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
AE 401.1. Understand the various engineering properties of different construction materials i.e. cement, concrete, steel etc.	6	0	1	1	8
AE 401.2. Understand the applications of different building components i.e. lintels, arches, stair cases etc. and also various types of engineering works included in the construction of a structure.	6	0	1	1	8
AE 401.3: Learn about different types of agricultural buildings, their applications and design theory.	6	0	1	1	8
AE 401.4: Understand the different types of estimates and factors affecting the costs of a building and cost analysis.	6	0	1	1	8
AE 401.5: Specify the different measurement and pricing techniques, calculating benefit to cost ratios and thus the feasibility of a project	6	0	1	1	8
Total Hours	30	0	5	5	40

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Understand the various engineering properties of different construction materials i.e. cement, concrete, steel etc.	03	01	01	05
CO-2	Understand the applications of different building components i.e. lintels, arches, stair cases etc. and also various types of engineering works included in the construction of a structure.	02	06	02	10
CO-3	Learn about different types of agricultural buildings, their applications and design theory**.**	03	07	05	15
CO-4	Understand the different types of estimates and factors affecting the costs of a building and cost analysis.	-	10	05	15
CO-5	Specify the different measurement and pricing techniques, calculating benefit to cost ratios and thus the feasibility of a project.	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Building Construction and Cost Estimation 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to various Constructional 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	Estimation costing specification and valuation in civil engineering	M. Chakravarti		1992
2	A textbook of estimation and costing (civil)	DD Kohli & RC Kohli	S. Chand Publishing	2012
3	Estimation and Costing in civil engineering	BN Dutta	UBS Publishers Distributors Pvt Ltd.	2016
4	Building Construction	Dr. B C Punmia	Laxmi Publications	2016

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Cos, Pos and PSOs Mapping

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Understand the various engineering properties of different construction materials i.e. cement, concrete, steel etc.	3	3	2	-	-	2	2	-	3	1	3	3	3	3	3	2
CO-2 Understand the applications of different building components i.e. lintels, arches, stair cases etc. and also various types of engineering works included in the construction of a structure.	3	3	2	-	-	2	2	-	3	1	3	3	3	3	2	-
CO-3 Learn about different types of agricultural buildings, their applications and design theory**.**	3	3	2	-	-	2	2	-	3	1	3	3	3	3	3	3
CO-4 Understand the different types of estimates and factors affecting the costs of a building and cost analysis.	3	3	2	-	-	2	2	-	3	1	3	3	3	3	2	-
CO-5 Specify the different measurement and pricing techniques, calculating benefit to cost ratios and thus the feasibility of a project.	3	3	2	-	-	2	2	-	3	1	3	3	3	3	2	-

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**	**CO-1** Understand the various engineering properties of different construction materials i.e. cement, concrete, steel etc.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**Unit-1.0 Building materials and their engineering properties.** **1.1,1.2,1.3,1.4,1.5,1.6**	-	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-2** Understand the applications of different building components i.e. lintels, arches, stair cases etc. and also various types of engineering works included in the construction of a structure.	**SO2.1** **SO.2** **SO2.3** **SO2.4** **SO2.5**	**Unit-2.0 Different buildingcomponents and engineering works.** **2.1,2.2,2.3,2.4,2.5,2.6**	-	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-3** Learn about different types of agricultural buildings, their applications and design theory.	**SO3.1** **SO3.2** **SO3.3** **SO3.4** **SO3.5**	**Unit-3.0 Different types of agricultural buildings and their design procedures.** **3.1,3.2,3.3,3.4,3.5,3.6**	-	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-4** Understand the different types of estimates and factors affecting the costs of a building and cost analysis.	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5**	**Unit-4.0 Construction economics.** **4.1,4.2,4.3,4.4,4.5,4.6**		
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-5** Specify the different measurement and pricing techniques, calculating benefit to cost ratios and thus the feasibility of a project.	**SO5.1** **SO5.2** **SO5.3** **SO5.4** **SO5.5**	**Unit 5: Measurement and pricing.** **5.1,5.2,5.3,5.4,5.5,5.6**		

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code:	22ME471
Course Title:	**Auto CAD Applications**
Pre-requisite:	Student should have basic knowledge of engineering drawing, machine design and computer.
Rationale:	AutoCAD offers a powerful and versatile platform for creating precise technical drawings. Its ability to handle 2D multi-view drawings with accurate dimensions, generate clear section views for internal details, and utilize standardized symbols for efficient communication makes it an essential tool for engineers, designers, and drafters across various industries. While AutoCAD offers basic 3D modeling capabilities, its core strength lies in establishing a solid foundation for technical documentation and serves as a valuable stepping stone for more advanced 3D software.

Course Outcomes:

AE 402.1: Students will gain proficiency in using Computer-Aided Design (CAD) software for creating 2D and 3D drawings

AE 402.2: Students understands the modify II, layer commands, dimension, hatch & gradient, drawing format and how to print in different page format.

AE 402.3: Students will be able to create drawings of agricultural machinery and build their projects as per industry standards.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
ESC	**22ME471**	**Auto CAD Applications**	0	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:** 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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
ESC	**22ME471**	Auto CAD Applications (Lab)	30	0	0	10	10	50	50	100
		Total								**100**

AE 402.1: Students will gain proficiency in using Computer-Aided Design (CAD) software for creating 2D and 3D drawings

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	0	10	1	2	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Students will able to understand the overview of AutoCAD. **SO1.2** Students will understand the purpose and usage of tools in the Draw and Dimension toolbars. **SO1.3** Student will practice on draw tools & modify tools in AutoCAD **SO1.4** Students will be able to utilize OSNAP, line thickness, and format tools for precise drawing creation.	• Application of computers for design. • CAD- Overview of CAD window – Explanation of various options on drawing screen. • Study of draw and dimension tool bar. • Practice of draw tools (Line, circle etc.) • Practice on draw and dimension tool bar. • Study of OSNAP, line thickness and format tool bar • Practice of OSNAP, line thickness and format tool bar • Study on modify I tools • Practice on modify tools (mirror, offset and array commands) • Practice on trim, extend, chamfer and fillet commands.		1. Search & learn online tutorials and resources for independent learning of CAD software. 2. Practice & create a basic 2D drawing in free time.

Assignments:

- Write the features and applications of AutoCAD.

Mini Project:

- Students will create a 2D drawing of a simple machine part using the Draw toolbar.

AE 402.2: Students understands the modify II, layer commands, dimension, hatch & gradient, drawing format and how to print in different page format.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	0	10	2	1	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Students will be able to utilize modify tools for proficiency & precision drawing. **SO2.2** Students will learn how to make dimensions in a drawing. **SO2.3** Students will understand the layer command and know how to use it to create a drawing. **SO2.4** Students learn different types of pages available for drawing and understand their setting as per drawing and then become ready to print their drawings	• Study of copy, move, scale, offset and rotate commands. • Practice on copy, move, and scale and rotate commands. • Study of layer commands. • Practice on layer commands. • Drawing of 2D- drawing using draw tool bar • Learn of creating boundary, region, hatch and gradient commands • Practice on creating boundary, region, hatch and gradient commands • Practice on Editing polyline- PEDIT and Explode commands. • Setting of view ports for sketched drawings • Printing of selected view ports in various paper sizes.		1. Search & learn online tutorials and resources for layer and hatch commands

Assignments:

i. Draw a 2 D diagram of machine components using layer commands then print and file in your practical copy.

ii. Prepare drawing of machine components and apply hatch & gradient then print and file in your practical copy.

Mini Project:

i. Prepare a layout of dairy plant for 50 cows.

AE 402.3: **Students will be able to create drawings of agricultural machinery and build their projects as per industry standards.**

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	0	10	2	2	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Students accurately draw machine parts (footstep bearing, knuckle joint) with all necessary dimensions. **SO3.2** Develop proficiency in drawing standard fasteners (hexagonal nuts, bolts) using appropriate symbols and dimensions. **SO3.3** Understand the concept of allowances and their importance in manufacturing. **SO3.4** Develop the ability to draw 3D drawings	• 2D- drawing of machine parts with all dimensions and allowances • Draw foot step bearing and knuckle joint. • Design a gear in 2D. • Drawing of hexagonal, nut and bolt and other machine parts. • Study of 3D commands • Practice on 3-D commands- Extrusion and loft • Practice on 3-D commands-on sweep and press pull. • Practice on 3-D Commands- revolving and joining • Introduction to other 3D software. • Demonstration on CNC machine and simple problems		1. Research different types of section views (full, half, offset) and their applications. Explore hatching patterns and their representation of materials. 2. Search the 3D drawings of machine components and learn how to make it.

Assignments:

- Create dimensioned 2D drawings of a footstep bearing and a knuckle joint. Include details like clearances, hole diameters, and bolt placements. Refer to standard drawing practices for dimensioning conventions.
- Practice drawing various fasteners (nuts, bolts, washers) using standard symbols and dimensions. Ensure clarity and proper scale.

Mini Project:

- 2D Design an engine component (cylinder block, piston etc.)

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl + SW + Sl)
AE **402**.1: Students will gain proficiency in using Computer-Aided Design (CAD) software for creating 2D and 3D	0	10	1	2	13
AE **402**.2: Students understands the modify II, layer commands, dimension,	0	10	2	1	13
AE **402**.3: Students will be able to create drawings of agricultural machinery and build their projects	0	10	2	2	14
Total Hours	**0**	**30**	**5**	**5**	**40**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Students will gain proficiency in using Computer-Aided Design (CAD) software for creating 2D and 3D	5	5	20	30
CO-2	Students understands the modify II, layer commands, dimension	5	10	22	37
CO-3	Students will be able to create drawings of agricultural machinery and build their projects as	5	5	23	33
Total		**15**	**20**	**65**	**100**

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

The end of semester assessment for AutoCAD Applications**,** Lab will be held with written examination of 100 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author/s	Publisher	Edition & Year
1	CAD/CAM Principles and Applications	Posinasetti Nageswara Rao	McGraw-Hill Education Pvt. Ltd	2002
2	CAD/CAM Theory and Practice	Sareen Kuldeep and Chandan Deep Grewal	S.Chand & Company Ltd., New Delhi.	2010
3	Mastering CAD/CAM with Engineering	Zeid Ibrahim	McGraw-Hill Education Pvt. Ltd., New Delhi.	2011
4	Principles of CAD/CAM/CAE Systems	Lee Kunwoo	Addison Vesley Longman, Inc	1999
5	YouTube tutorials & video lectures			
6	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

Curriculum Development Team

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7. Er Pratibha Shiv, Assistant Professor, Dept. of Agricultural Engineering

Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22ME471

Course Title: Auto CAD Applications

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Students will gain proficiency in using Computer-Aided Design (CAD) software for creating 2D and 3D	3	3	2	2	3	3	-	-	2	1	3	2	3	3	3	2
CO-2 Students understands the modify II, layer commands, dimension	2	2	1	1	3	3	-	-	2	1	-	2	2	2	2	2
CO-3 Students will be able to create drawings of agricultural machinery and build their projects as	3	3	2	3	3	3	-	-	2	1	2	2	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**	**CO-1** Students will gain proficiency in using Computer-Aided Design (CAD) software for creating 2D and 3D	SO1.1 SO1.2 SO1.3 SO1.4	**Unit-1.0 Study about drawing tools** **1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10**	-	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-2** Students understands the modify II, layer commands, dimension	SO1.1 SO1.2 SO1.3 SO1.4	**Unit-1.0 Study about Modify tools** **2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10**	-	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-3**Students will be able to create drawings of agricultural machinery and build their projects as per industry standards.	SO1.1 SO1.2 SO1.3 SO1.4	**Unit-1.0 Create 2D drawings** **3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10**	-	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering and Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code:	**22EE422**
Course Title:	**Applied Electronics and Instrumentation**
Pre- requisite:	Student should have basic knowledge of mathematics, physics, 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 measurements.

Course Outcomes:

AE 403.1: Understanding of the concept of fundamentals of digital electronics introducing number system its types and Boolean algebra

AE 403.2: Introduction of Combinational logic circuits, Sequential logic circuits and their types.

AE 403.3: Understanding the concept of Different electronic components and their working principles.

AE 403.4: Explain the principle, construction and working of Electronics circuits.

AE 403.5: Introducing the concept of Generalized Instrumentation and different measuring instruments

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(PCC)	**22EE422**	**Applied Electronics and Instrumentation**	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:

Theory

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	22EE425	**Watershed Hydrology (Theory)**	0	15	15	0	0	30	50	80
		Watershed Hydrology (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 403.1: Understanding of the concept of fundamentals of digital electronics introducing number system its types and Boolean algebra

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	0	1	1	7

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the concept of Analog and Digital Electronics **SO1.2** Understand the concept of number system and its types. **SO1.3** Understand the concept of Boolean Algebra		**Unit-1: Digital Fundamentals** 1.1 Introduction to Number System 1.2 Conversions of Decimal, Binary, octal, hexadecimal, 1.3 Binary number complements, binary operation floating point and signed numbers. 1.4 Basic theorem of Boolean algebra 1.5 Examples of Boolean algebra	1. Basic mathematical formulas 2. Basic of logic gates

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Theoretical Assignments of Boolean algebra
- Numerical Problems Related to Number system and Boolean algebra

AE 403.2: Introduction of Combinational logic circuits, Sequential logic circuits and their types.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	1	1	7

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understanding of concept of combination logic circuits and sequential circuits **SO2.2** Explanation of Logic Gates **SO2.3** Learn the Procedure of SOP and K Map **SO2.4** Understand the structure and operation of Analog -Digital converters	1. To study about AND, NOT, and OR gates.	**Unit-2: Logic Circuits** 1.1 Combinational Logic Circuits (basic gates (AND, OR, NOR), 1.2 Explanation of SOP rule and K map 1.3 A/D converters Binary ladder D/A converter, successive approximation A/D converter, 1.4 half and full adder circuits, 1.5 Sequential logic circuits R-S flip flop, J-K flip flop.	1. Concept of Logic Gates 2. SOP and K map Their Types. 3. Mathematical formulas

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignment related to different Logic Gates

ii. Numerical Problems SOP and K-Map

a. Mini Project:

i. Draw a Poster of A/D converters

AE 403.3: Understanding the concept of Different electronic components and their working principles.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	7	6	1	1	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To discuss role of passive components and semiconductor material **SO3.2** To study of diode and its application **SO3.3** To understand the BJT and its configuration.	1. To study V-I characteristics of p-n junction diode; 2. To study half wave, full wave and bridge rectifier; 3. To study transistor characteristics in CE configurations;	**Unit-3: Passive Components** 1.1 Introduction to Resistors-Inductors and Capacitors and their types. 1.2 Introduction to semiconductors, Diodes, V-I characteristics 1.3 Diode as rectifier, various type of rectifier (half wave, full wave and bridge) 1.4 Bipolar junction Transistor and their working, 1.5 introduction to CC, CB & CE transistor configurations, different configuration 1.6 Modes of operation of BJT 1.7 DC biasing of BJT (fixed, self, potential divider, direct coupling).	1. Different Types of semiconductor material 2. Diodes and its types

SW-3 Suggested Sessional Work (SW):

b. Assignments:

i. Theoretical Assignments related to different DC biasing,

ii. Theoretical Assignments related to different configuration of Transistor

AE 403.4: Explain the principle, construction and working of Electronics circuits.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	10	1	1	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Discuss the role of transistor Applications. **SO4.2** Understand the building Blocks and operation of different types of voltage Regulator **SO4.3** Understand the building Blocks and operation of different types of Operational Amplifier. **SO4.4** Understand the building Blocks and operation of different types of Oscillators and Amplifiers	1. To study an OP-AMP IC 741 as inverting and noninverting amplifier; 2. To study a OP-AMP IC 741 as differentiator amplifier; 3. To study a differential amplifier using two transistor; 4. To study a OP-AMP IC 741 as differential amplifier; 5. Study a OP-AMP IC 741 as a comparator;	**Unit-4: Transistor Circuits and Applications** 1.1 Voltage regulator using zener diode, 1.2 Series and shunt regulator using transistor (Transistor series regulator, controlled transistor series regulator, shunt Transistor voltage regulator, Transistor current regulator.) 1.3 Phase shift oscillator, analysis of differential amplifier using transistor, 1.4 ideal OP-AMP characteristics, linear and non-linear application of OP-AMP (adder, subtractor, integrator, active filter, comparator, differentiator) 1.5 Differential instrumentation amplifier and oscillator 1.6 OP- Amp as voltage regulator.	1. Basic working principle of diode 2. Basic working principle of transistor

SW-4 **Suggested Sessional Work (SW):**

a. Assignments:

i. Theoretical Assignments Based on Different types of voltage regulator.

ii. Theoretical Assignments related to phase shift oscillator and operational amplifier.

c. Mini Project:

ii. Draw a block diagram chart of different operational amplifier.

AE 403.5: Introducing the concept of Generalized Instrumentation and different measuring instruments.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	1	1	9

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**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.To familiarize with various types of transducers.	**Unit 5: Generalized instrumentation** 1.1 Introduction to Generalized instrumentation and its b locks diagram 1.2 measurement of displacement, temperature, 1.3 measurement of velocity, force and pressure using potentiometer, 1.4 Resistance thermometer, 1.5 thermocouples, bourden tube, 1.6 LVDT, strain gauge and 1.7 Tacho-generator	1. Structure and operation of potentiometer 2. Thermometers

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Theoretical Assignment based on Different Measuring instruments.

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b. Mini Project:

Draw the chart of Different Types of measuring instruments.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab instructions	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
AE 403.1: Understanding of the concept of fundamentals of digital electronics introducing number system its types and Boolean algebra	05	0	1	1	07
AE 403.2: Introduction of Combinational logic circuits, Sequential logic circuits and their types.	05	2	1	1	07
AE 403.3: Understanding the concept of Different electronic components and their working principles.	07	6	1	1	09
AE 403.4: Explain the principle, construction and working of Electronics circuits.	06	10	1	1	08
AE 403.5: Introducing the concept of Generalized Instrumentation and different measuring instruments.	07	2	1	1	11
Total Hours	**30**	**20**	**5**	**5**	**60**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Digital Fundamentals	02	05	03	10
CO-2	Logic circuits	04	06	00	10
CO-3	Passive Components	02	06	02	10
CO-4	Transistor Circuits and Applications	03	07	00	10
CO-5	Generalized instrumentation	03	05	02	10
Total		14	29	07	50

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

The end of semester assessment for Applied Electronics and Instrumentation 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
2. Tutorial
3. Group Discussion
4. Practical Demonstration of Instruments.
5. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, WhatApp, Mobile, Online sources)
6. Brainstorming

Suggested Learning Resources:

(a) 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
5	Lecture note provided by Dept. of Electrical Engineering, AKS University, Satna.			

Cos, Pos and PSOs Mapping

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Understanding of the concept of fundamentals of digital electronics introducing number system its types and Boolean algebra	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2: Introduction of Combinational logic circuits, Sequential logic circuits and their types.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3: Understanding the concept of Different electronic components and their working principles.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO 4 Explain the principle, construction and working of Electronics circuits.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO 5: Introducing the concept of Generalized Instrumentation and different measuring instruments.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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**	CO1: Understanding of the concept of fundamentals of digital electronics introducing number system its types and Boolean algebra	**SO1.1** **SO1.2** **SO1.3**	**As Mentioned along with the concern units**	**UNIT-1: Signal and system properties** 1.1,1.2,1.3,1.4,1.5	**As Mentioned along with the concern units**
PO:1,2,3,4,5,6,7,8,9,10,11,12 **PSO 1,2,3,4**	CO2: Introduction of Combinational logic circuits, Sequential logic circuits and their types.	**SO2.1** **SO2.2** **SO2.3** **SO2.4**		**UNIT-2**: **Behavior of continuous and discrete-time LTI systems** 2.1, 2.2, 2.3, 2.4, 2.5	
PO:1,2,3,4,5,6,7,8,9,10,11,12 **PSO 1,2,3,4**	CO3: Understanding the concept of Different electronic components and their working principles.	**SO3.1** **SO3.2** **SO3.3**		**Unit-3: Fourier Series and Fourier Transform** 3.1,3.2,3.3,3.4,3.5,3.6,3.7	
PO:1,2,3,4,5,6,7,8,9,10,11,12 **PSO 1,2,3,4**	CO 4: Explain the principle, construction and working of Electronics circuits.	**SO4.1** **SO4.2** **SO4.3** **SO4.4**		**UNIT-4: Laplace and z- Transforms** 4.1,4.2,4.3,4.4,4.5,4.6	
PO:1,2,3,4,5,6,7,8,9,10,11,12 **PSO 1,2,3,4**	CO5: Introducing the concept of Generalized Instrumentation and different measuring instruments.	**SO5.1** **SO5.2** **SO5.3** **SO5.4**		**UNIT-5: Sampling and Reconstruction** 5.1,5.2,5.3,5.4,5.5,5.6,5.7	

AKS UNIVERSITY, SATNA
Faculty of Agriculture Science and Technology
Department of Agriculture Engineering and Food technology

B.Tech. (Agricultural Engineering) Programme
Semester-IV

Course Code:	**22AE423**
Course Title:	**Tractor and Automotive Engines**
Pre- requisite:	Student should have basic knowledge of thermodynamic principles like work, heat, efficiency, automotive engine & their components.
Rationale	The students studying agricultural engineering should possess foundational of the comprehensive study and implementation of conventional and non-conventional energy sources is essential for ensuring sustainable and efficient agricultural practices. Understanding the thermodynamics of principle of engines. Knowledge of the general energy equation and heat balance sheet allows for comprehensive assessment of energy flows within engines. Additionally, exploring topics like engine valve systems, air cleaning systems, fuel supply systems, lubrication systems, cooling systems, ignition systems, and electrical systems provides a holistic understanding of engine operation and maintenance. Familiarization with engine testing basics facilitates the evaluation and optimization of engine performance, ensuring efficient utilization of farm power resources.

Course Outcomes:

AE 404.1: Students able to apply able to compare and contrast conventional (fossil fuels) and non-conventional (renewable) energy sources used for powering agricultural machinery.
AE 404.2: Students understanding of different tractor types and how internal combustion engines, categorized as Compression Ignition (CI) and Spark Ignition (SI), are classified based on their operating principles.

AE 404.3: Students understand the importance of clean air and explore air cleaning technologies as well as fuel supply system including fuel air ratio calculation.
AE 404.4: Students able to understand the function of carburetor and injector also know about governor system to control the rated rpm of tractor.
AE 404.5: Students gain the knowledge about different tractor system

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Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week) CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	Total Credits(C)
PCC	22AE423	**Tractor and Automotive Engines**	3	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks) Progressive Assessment (PRA) Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
PCC	**22AE423**	**Tractor and Automotive Engines (Theory)**	0	15	15	0	0	30	50	80
		Tractor and Automotive Engines (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 404.1: Students able to apply able to compare and contrast conventional (fossil fuels) and non-conventional (renewable) energy sources used for powering agricultural machinery.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	4	1	1	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (S)**
SO1.1 Understand sources of farm power for operate agricultural machinery **SO1.2** Student gain the knowledge thermodynamics principle of IC engine **SO1.3** Students gain the knowledge of energy equation and heat balance sheet **SO1.4** Student evaluate the mechanical, thermal and volumetric efficiencies if IC engine. .	1.1 Tractor engine heat balance and engine performance curves 1.2 Numerical to find out the efficiency of IC Engine	**Unit-1.0 Farm power sources and Engine thermodynamics** 1.1 Study of sources of farm power 1.2 Classification of tractors and IC engines 1.3 Thermodynamic principles of IC 1.4 General energy equation and heat balance sheet 1.5Study of mechanical, thermal and volumetric efficiencies.	1. Classify different types of tractors based on engine type (diesel, gasoline), number of wheels (2WD, 4WD), and hitch type (3-point, drawbar). Research their applications and limitations.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Analyze the theoretical Otto cycle (SI engine) and Diesel cycle (CI engine) using Pressure-Volume (P-V) diagrams. Solve the numerical for hydraulic system of tractor

b. Mini Project:

i. Evaluate the feasibility of using different energy sources (conventional vs. non-conventional) based on factors like cost, efficiency, and environmental impact.

c. Other Activities (Specify):

i. Visit a local farm or agricultural dealership to see different types of tractors and engines in operation.

AE 404.2: **Students understanding of different tractor types and how internal combustion engines, categorized as Compression Ignition (CI) and Spark Ignition (SI), are classified based on their operating principles.**

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	6	1	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (S)**
SO2.1 Analyze the function of engine components and its function **SO2.2** Analyze and differentiate between 2-stroke and 4-stroke engine cycles, along with the operating principles of CI (Compression Ignition) and SI (Spark Ignition) engines. **SO2.3** Understand the workings of engine valve systems, valve mechanisms, and valve timing diagrams. **SO2.4** Students understand the design of a cam profile to valve lift and valve opening area **SO2.5** Students able to identify how cam design and valve adjustments influence engine performance.	2.1 Introduction to different systems of CI engines; Engine parts and functions, working principles etc. 2.2 To Study about valve mechanism system 2.3 To Study about valve timing diagram	**Unit-2 Engine components & valve mechanism** 2.1 Study of engine components their construction & functions. 2.2 Comparison of 2-stroke and 4-stroke engine 2.3 Comparison of CI and SI engines. 2.4 Study of Engine Valve systems 2.5 Valve mechanism and valve timing diagram, and valve clearance adjustment 2.6 Study of Cam profile, valve lift and valve opening area. .	1. Explore the different types of valves (intake and exhaust), their working mechanisms, the importance of valve timing diagrams, and how to adjust valve clearances.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Design a simple cam profile for a desired engine characteristic (e.g., high torque, high power).

b. **Mini Project:**
   i. Draw a neat and clan sketch of valve timing diagram & explain it.

c. **Other Activities (Specify):**
   i. Collect the images of engine components and paste in a file.

AE 404.3: Students understand the importance of clean air and explore air cleaning technologies as well as fuel supply system including fuel air ratio calculation.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	6	1	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (S)**
SO3.1 Understand the critical role of air cleaning systems in protecting engines from harmful airborne contaminants and ensuring optimal performance. **SO3.2** Student understand the operation of fuel supply system and their functions in delivering fuel to the engine. **SO3.3** Grasp the importance of fuel properties and understand how to calculate the ideal air-fuel ratio for efficient engine combustion. **SO3.4** Student understands the detonation (knocking) in internal combustion engines, its negative effects, and potential control strategies.	3.1 To study about air cleaning system of tractor 3.2 To Study about fuel supply system 3.3 To determine the physical properties of fuel (Petrol & diesel)	**Unit-3: Air cleaning & fuel Supply system** 3.1 Study of importance of air cleaning system 3.2 Study of types of air cleaners and performance characteristics of various air cleaners 3.3 Study of fuel supply system 3.4 Study of fuels & properties of fuels, 3.5 Calculation of air-fuel ratio & tests on fuel 3.6 Study of detonation and knocking in IC engines	i. Calculate the air furl ration of different fuels (diesel, Petrol, kerosene and biomass etc.)

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Draw a neat sketch of fuel supply system of spark ignition and compression ignition and explain it

b. Mini Project:

i. Design a data sheet comparing the performance characteristics (CADR, noise level, energy consumption) of popular air cleaner models.

c. Other Activities (Specify):

i. Visit the tractor workshop clean the air cleaner of tractor.

AE 404.4: Students able to understand the function of carburetor and injector also know about governor system to control the rated rpm of tractor.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	6	2	1	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (S)**
SO4.1 Understands the operation of carburetor systems, their key components. **SO4.2** Students analyze fuel injection of system. **SO4.3** Students understand fuel injection of system in IC engine **SO4.4** Students will gain knowledge of fuel injector to atomize the fuel into the engine. **SO4.**5 Students understand the necessity of engine governors to regulate engine speed to maintain safe and efficient operation.	4.1 To study about diesel injection system & timing. 4.2 To Study about nozzle 4.3 To study about part load efficiencies & governing system of tractor	**Unit-4: Carburetor & Fuel Injection System** 4.1 Study of carburetion system and their main functional components 4.2 Study of fuel injection system 4.3 Fuel injector nozzles their types and working principle 4.4 Engine governing system 4.5 Numerical related to governor.	i. Research & analyze the role of sensors (e.g., air mass sensor) in a modern fuel injection system for optimal air-fuel ratio control. ii. Search the different type of governor system used in tractor

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Compare and contrast solenoid and piezo injector nozzles based on their actuation methods and response times.

b. Mini Project:

i. Build a simple carburetor model (using syringes, tubes, and containers) to demonstrate the air-fuel mixing process visually.

c. Other Activities (Specify):

i. Visit the tractor workshop and dismantle the carburetor and analyze its part.

AE 405.4: Students gain hands-on knowledge in evaluating tractor performance as per BIS code and standards.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	8	8	2	2	20

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (S)**
SO 5.1 Students understands the lubrication system to avoid friction of components. **SO 5.2** Students gain the knowledge of cooling system of tractor and identify the main functional components like radiators and thermostats. **SO 5.3** Students understand the ignition system of tractor**.** **SO 5.4** Students able to understand the fundamentals of engine testing procedures.	5.1 To study about Cooling system, and fan performance, thermostat and radiator performance evaluation 5.2 To study about Lubricating system & adjustments 5.3 To study about electrical system 5.4 To study about Ignition system	**Unit-5: Tractor Systems** 5.1 Study of lubrication system 5.2 Engine cooling system 5.3 Engine governing system 5,4 Study of need and type of thermostat valves 5.5 Study of radiator efficiency 5.6 Study of ignition system 5.7 Comparison of dynamo and alternator 5.8 Familiarization with the basics of engine testing	i. Research different types of lubrication systems in modern tractor. ii. Explore key physical properties of lubricants: viscosity, viscosity index, flash point, pour point.

SW-4 Suggested Sessional Work (SW):

a) Assignments:

i. Create a labeled diagram of a lubrication system, identifying each component and its function

ii. Create a labeled diagram of an SI engine ignition system, identifying each component and its function.

a. Mini Project:

i. Build a simple model radiator (using a container with fins and a heat source) to demonstrate the principles of heat transfer from coolant to air.

b. Other Activities (Specify):

i. Visit the tractor workshop observed the different system of tractor .

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+LI+ SW+SL)
AE404.1: Students able to apply able to compare and contrast conventional (fossil fuels) and non-conventional (renewable) energy sources used for powering agricultural machinery.	5	4	1	1	11
AE 404.2: Students understanding of different tractor types and how internal combustion engines, categorized as Compression Ignition (CI) and Spark Ignition (SI), are classified based on their operating principles.	6	6	1	1	14
AE 404.3: Students understand the importance of clean air and explore air cleaning technologies as well as fuel supply system including fuel air ratio calculation.	6	6	1	1	14
AE 404.4: Students able to understand the function of carburetor and injector also know about governor system to control the rated rpm of tractor.	5	6	2	1	14
AE 404.5: Students gain the knowledge about different tractor system	8	8	2	2	20
Total Hours	30	30	7	6	73

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Farm power sources and Engine thermodynamics	02	05	03	10
CO-2	Engine components & valve mechanism	02	05	03	10
CO-3	Air cleaning & fuel Supply system	03	07	05	15
CO-4	Carburetor & Fuel Injection System	03	07	05	15
CO-5	Tractor Systems				
Total		10	24	16	50

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

The end of semester assessment for Tractor System and Control will be held with writtenexamination 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to tractor testing Institute (Bhudni, Bhopla , M.P.)
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) **Books:**

S. No.	Title	Author	Publisher	Edition &Year
1	Tractors and Their Power Units	D. Smith, John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki	Springer US	2012
2	Elements of Agricultural Engineering	Jagdishwar Sahay	Standard Publishers Distributors	Fifth Edition 2015
3.	Automobile Engineering	Dr. D.S. Kumar	S K Kataria & Sons	2006
2.	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22AE423

Course Title: Tractor and Automotive Engines

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Students able to apply able to compare and contrast conventional (fossil fuels) and non-conventional (renewable) energy sources used for powering agricultural machinery.	2	2	2	2	2	2	3	1	1	1	1	1	2	3	3	2
CO 2: Students understanding of different tractor types and how internal combustion engines, categorized as Compression Ignition (CI) and Spark Ignition (SI), are classified based on their operating principles.	3	2	2	3	3	2	2	1	2	1	1	1	2	3	2	2
CO3: Students understand the importance of clean air and explore air cleaning technologies as well as fuel supply system including fuel air ratio calculation.	3	3	2	2	2	2	2	1	1	2	1	1	1	2	3	2
CO4: Students able to understand the function of carburetor and injector also know about governor system to control the rated rpm of tractor.	3	3	2	3	2	2	2	1	2	2	1	1	3	3	3	2
CO5: Students gain the knowledge about different tractor system	3	3	2	3	2	2	2	1	1	1	1	1		3	2	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	CO-1: Students able to apply able to compare and contrast conventional (fossil fuels) and non-conventional (renewable) energy sources used for powering agricultural machinery	SO1.1 SO1.2 SO1.3 SO1.4	LI 1.1 LI 1.2	Unit-1.0 **Agricultural Tractor Design Fundamentals** 1.1,1.2,1.3,1.4,1.5	As mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-2: Students understanding of different tractor types and how internal combustion engines, categorized as Compression Ignition (CI) and Spark Ignition (SI), are classified based on their operating principles.	SO2.1 SO2.2 SO2.3 SO2.4	LI 2.1 LI 2.2 LI 2.3	Unit-2 **Design of mechanical power transmission** 2.1, 2.2, 2.3, 2.4, 2.5,2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-3: Students understand the importance of clean air and explore air cleaning technologies as well as fuel supply system including fuel air ratio calculation.	SO3.1 SO3.2 SO3.3	LI 3.1 LI 3.2 LI 3.3	Unit-3 : **Design of Engine components** 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-4: Students able to understand the function of carburetor and injector also know about governor system to control the rated rpm of tractor.	SO4.1 SO4.2 SO4.3 SO4.4	LI 4.1 LI 4.2 LI 4.3	Unit-4 : **Tractor Testing Procedure** 4.1, 4.2, 4.3, 4.4, 4.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-5 Students gain the knowledge about different tractor system	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI 5.1 LI 5.2 LI 5.3 LI 5.4	Unit-5 : **Tractor Testing Procedure** 5.1, 5.2, 5.3, 5.4, 5.5,5.6,5.7,5.8	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Engineering and Food technology
Department of Agricultural Engineering

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code: **22HO524**

Course Title: **Engineering Properties of Agricultural Produce**

Pre-requisite: Well, understanding the biological structure and composition of agricultural produce along with engineering principles and problem-solving approaches would be beneficial for successful learning of this specific subject.

Rationale: Overall, understanding the engineering properties of agricultural produce empowers learners to develop efficient, cost-effective, and sustainable practices throughout the agricultural value chain, ultimately leading to better quality and safer food products for consumers. As per the subject content, students will be equipped with the technical knowledge and practical skills to design efficient and safe food processing systems and contribute to new product development.

Course Outcomes:

AE 405.1: Analyze the various engineering properties of grains, fruits, and vegetables (e.g., shape, size, density, porosity, thermal properties, friction properties, rheological properties, electrical properties).

AE 405.2: Apply the knowledge of engineering properties to design and develop 1equipment for post-harvest handling, processing, and storage of agricultural produce.

AE 405.3: Evaluate the effects of different handling and processing operations on the quality and safety of agricultural produce.

AE 405.4: Applying engineering principles to solve problems related to food processing. This could involve designing or selecting appropriate equipment, optimizing processes for efficiency, or minimizing losses.

AE 405.5: Apply the knowledge to Measurement Techniques for determining the various engineering properties of agricultural produce and modeling and simulating the behavior of agricultural produce during handling and storage.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PCC	**22HO524**	**Engineering Properties of Agricultural Produce**	1	1	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
PCC	**22HO524**	**Engineering Properties of Agricultural Produce (Theory)**	0	15	15	0	0	30	50	80
		Engineering Properties of Agricultural Produce (Practical/Lab)	15	0	0	5	0	20	0	20
		Total								**100**

AE 405.1: Physical Properties of Biological Materials

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	3	4	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Define the term "physical property" and differentiate it from chemical properties. **SO1.2** Analyze and evaluate the significances these properties in different food preservation techniques. **SO1.3** Explain the relationship between the structure and composition of biological materials (e.g., presence of water, proteins, carbohydrates) and their physical properties. **SO1.4** Apply engineering knowledge to compare and contrast the physical properties of different biological materials (e.g., fruit vs. grains, wood vs. cellulose). **SO1.5** Apply their knowledge of physical properties to explain real-world phenomena related to biological materials.	1.1 Determination of the shape and size of grains, fruits and vegetables, 1.2 Determination of bulk density and angle of repose of grains, 1.3 Determination of the particle density/truedensity and porosity of solid grains	**Unit-1.0** **PHYSICAL PROPERTIES** Classification and importance of engineering properties of Agricultural Produce i.e. shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surfacearea of grains, fruits and vegetables,	1. Scope and importance of Engineering Properties of Agricultural Produces 2. Various applications of these Properties.

Assignments:

- Hands-on exploration of various biological materials to observe their physical properties.
- Group discussions on the significance of specific properties in biological systems.

Mini Project:

- Case studies analyzing how physical properties influence the behavior of biological materials in specific contexts.

AE 405.2: Thermal Property of Agricultural Produces

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	3	4	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Define key thermal properties of biological materials, such as specific heat, thermal conductivity, and heat of respiration. **SO2.2** Identify the applications of friction knowledge in designing equipment for handling and processing agricultural produce (e.g., conveyors, elevators). **SO2.3** Explain the purpose and principles behind various processing techniques used for different dairy products (e.g., butter churning, cheese curd formation). **SO2.4** Analyze the thermal challenges associated with preserving biological materials. **SO2.5** Propose strategies for manipulating thermal properties of biological materials for specific applications.	• Finding the thermal conductivity of different grains, • Determination of specific heat of some food grains.	**Unit-2.0** **THERMAL PROPERTY** Thermal properties, Heat capacity, Specific heat, Thermal conductivity, Thermal diffusivity, Heat of respiration; Co-efficient of thermal expansion.	1. Describe common methods for measuring thermal properties of biological materials (e.g., differential scanning calorimetry, thermal conductivity meters etc.). 2. Explain the significance of these properties in processes and applications.

Assignments:

- Hands-on exploration of various biological materials to observe their thermal properties.
- Group discussions on the significance of specific properties in biological systems.

Mini Project:

- Case studies analyzing how thermal properties influence the behavior of food materials in specific contexts.

AE 405.3: Friction and Aerodynamic Properties of Agricultural Produces

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	3	4	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Demonstrate a comprehensive understanding of the principles friction and aerodynamic properties. **SO3.2** Apply friction and aerodynamic properties to select and design equipment for different processing and handling operations. **SO3.3** Analyze the impact of friction on potential damage to agricultural produce during different handling operations. **SO3.4** Evaluate the influence of these properties on the efficiency of drying processes for agricultural produce. **SO3.5** Integrate principles to design of storage and transportation facilities.	• Finding the co-efficient of external and internal friction of different crops. • Finding out the terminal velocity of grain sample and study the separating behaviour in a vertical wind tunnel.	**Unit-3.0** **Friction:** Friction in agricultural materials; Static friction, Kinetic friction, rolling resistance, Angle of internal friction, Angle of repose, Flow of bulk granular materials, **Aerodynamic Property**: Aerodynamics of agricultural products, drag coefficients, terminal velocity.	1. Evaluate the economic feasibility and sustainability considerations when designing dairy plants including optimizing energy usage, minimizing waste generation, and considering the environmental impact of different plant designs 2. Significance of proper cleaning procedures, minimizing contamination risks, and adhering to regulatory requirements.

Assignments:

- Identify and troubleshoot problems related to excessive friction during handling of agricultural produce.
- Design a basic storage system for an agricultural product considering its aerodynamic properties to prevent wind dispersal.

Mini Project:

Case Study: Analyze a case study where understanding aerodynamic properties is crucial for optimizing a post-harvest operation (e.g., grain storage, seed dispersal).

AE 405.4: Rheological Properties of Agricultural Produces

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	4	4	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 Define rheology and its importance in understanding the flow behavior of agricultural products. **SO4.2** Analyze the flow behavior of various agri-produces (e.g., juices, pastes, slurries) using basic rheological concepts.. **SO4.3** Explain the impact of rheological properties on different post-harvest operations like pumping, mixing, and processing of agri-produces. **SO4.4** Analyze and explain the impact of rheological properties on different post-harvest operations like pumping, mixing, and processing of agri-produces. **SO4.5** Recommend appropriate techniques for measuring rheological properties of different agri-produces.	• Determination of hardness of food material • Determination of viscosity of liquid foods	**Unit-4.0** **Rheological properties;** force, deformation, stress, strain, elastic, plastic and viscous behaviour, **Newtonian and Non-Newtonian liquid**, Visco - elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic, Rheopectic and Bingham Plastic Fluids, **Flow curves**	1. **Thermal Processing Method Comparison:** Research and compare two different thermal processing methods (e.g., pasteurization, sterilization, hot-fill canning) 2. Scope and Importance of Canning in Food Processing

Assignments:

- Propose solutions to overcome challenges related to the rheological properties of agri-produces during handling and processing.
- Communicate their understanding of rheological properties effectively through written reports or presentations.

Mini Project:

- A hands-on session where students can measure the rheological properties of actual agri-produce samples using simple tools (e.g., viscometers).

AE 405.5: Electrical Property of Agricultural Produces

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	2	2	2	1	07

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Apply engineering knowledge to solve complex problems related to Electrical Property of foods. **SO5.2** Explain the factors affecting the electrical properties of agricultural produce. **SO5.3** Innovation and developments in potential applications of electrical property measurement in agriculture. **SO5.4** Analyze how electrical properties can be used to optimize post-harvest handling and processing of agricultural produce. **SO5.5** Identify potential limitations and challenges associated with using electrical properties for agricultural applications.	• Determination of conductivity and dielectric constant of food materials.	**Unit-5.0** **Electrical Property** : Electrical properties; dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant, Method of determination. Application of engineering properties in handling processing machines and storage structures	1. Fundamental electrical properties of agricultural produce and their potential applications in various post-harvest operations. 2. Various Novel processing methods in Food Processing.

Assignments:

Discuss the commercial application of electrical property of agricultural products used in Food Industry.

Mini Project:

- Investigate recent research on the use of electrical properties for novel post-harvest treatments of agricultural products.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (Cl + LI+SW + SL)
AE 405.1: Physical Properties of Biological Materials	3	4	2	2	11
AE 405.2: Thermal Property of Agricultural Produces	3	4	2	2	11
AE 405.3: Friction and Aerodynamic Properties of Agricultural Produces	3	4	2	2	11
AE 405.4: Rheological Properties of Agricultural Produces	4	4	2	2	11
AE 405.5: Electrical Property of Agricultural Produces	2	2	2	2	8
Total Hours	**15**	**18**	**10**	**10**	**53**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Thermal Property of Agricultural Produces	04	05	01	10
CO-2	Friction and Aerodynamic Properties of Agricultural Produces	04	04	02	10
CO-3	Rheological Properties of Agricultural Produces	05	04	03	11
CO-4	Electrical Property of Agricultural Produces	04	05	03	12
CO-5	Thermal Property of Agricultural Produces	03	02	02	07
Total		**20**	**20**	**10**	**50**

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

The end of semester assessment for Engineering Properties of Agricultural produce 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to milk processing plants
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/s	Publisher	Edition & Year
1	Unit operations of Agricultural Processing	Sahay, K.M. and Singh, K.K.	Vikas Publishing house Pvt. Ltd. New Delhi	1994
2	Physical Properties of Plants & Animals.	Mohesin, N.N.	Gordon & Breach Science Publishers , New York.	1980
3	Engineering Properties of Biological Materials	OP Singhal & DVK Samuel.	Saroj Prakashan	2003
4	Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi			
5	McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.			
6	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
7	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code : 22HO501

Course Title: Engineering Properties of Agricultural Produces

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-01: Analyze the various engineering properties of grains, fruits, and vegetables	3	2	3	2	1	2	-	-	-	2	-	1	**2**	**3**	**3**	**3**
CO-02: Apply the knowledge of engineering properties to design and develop equipment	3	2	3	2	1	2	-	-	-	2	-	1	**2**	**2**	**2**	**1**
CO-03: Evaluate the effects of different handling and processing operations on the quality and safety	3	2	3	2	1	2	-	-	-	2	-	1	**3**	**2**	**2**	**1**
CO-04: Applying engineering principles to solve problems related to food processing	3	2	3	2	1	2	-	-	-	2	-	1	**3**	**3**	**3**	**2**
CO-05: Apply the knowledge to measurement techniques for determining the various engineering properties	3	2	3	2	1	2	-	-	-	2	-	1	**3**	**3**	**1**	**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-01:** Analyze the various engineering properties of grains, fruits, and vegetables	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**As Mentioned along with the concern units**	**AE 401.1:** Physical Properties of Biological Materials	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-02:** Apply the knowledge of engineering properties to design and develop equipment	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**AE 401.2:** Thermal Property of Agricultural Produces	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-03:** Evaluate the effects of different handling and processing operations on the quality and safety	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**AE 401.3:** Friction and Aerodynamic Properties of Agricultural Produces	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-04:** Applying engineering principles to solve problems related to food processing	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**AE 401.4:** Rheological Properties of Agricultural Produces	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-05:** Apply the knowledge to measurement techniques for determining the various engineering properties	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**AE 401.5:** Electrical Property of Agricultural Produces	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code:	**22AE425**
Course Title:	**Watershed Hydrology**
Pre- requisite:	Student should have basic knowledge of maps, filed measurement and its equipment.
Rationale:	The students studying Agricultural Engineering should possess foundational understanding about historical brief knowledge of surveying and levelling. This encompasses familiarity with the invention and evolution of surveying and leveling and its numerical for field work observation. Additionally, students think too acquire fundamental insights into various surveying and leveling.

Course Outcomes:

AE 406.1: A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource hydrology and environmental conservation.

AE 406.2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.

AE 406.3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water hydrology within watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.

AE 406.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed hydrology strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.

AE 406.5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed hydrology programs, incorporating principles of sustainability, community participation, and effective project manage.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(PCC)	**22AE425**	**Watershed Hydrology**	1	1	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	**22AE425**	**Watershed Hydrology (Theory)**	0	15	15	0	0	30	50	80
		Watershed Hydrology (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 406.1: A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource hydrology and environmental conservation.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	4	2	1	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1 This knowledge lays the groundwork for more advanced studies and practical applications in watershed hydrology **SO1.2** Knowledge to conduct effective watershed investigations and topographical surveys, laying the foundation for watershed hydrology practices. **SO1.3** Knowledge needed to assess, analyze, and implement effective watershed hydrology strategies based on the understanding of soil characteristics and vegetative cover. **SO1.4** The session, participants should be equipped with the knowledge and skills needed to assess, analyze, and promote sustainable land use practices within a watershed, contributing to the overall health and resilience of the ecosystem. **SO1.5** The session, participants should be equipped with the knowledge and skills necessary to navigate the socio-economic watershed.	1- Exercises on delineation of watersheds using toposheets. 2- Visit to meteorological observatory and study of different instruments.	**Unit-1.0** **Watershed - introduction and characteristics** 1.1 Introduction and characteristics. 1.2 Precipitation and its forms 1.3 Investigation,	1. The knowledge gained in practical contexts to enhance your understanding of watershed hydrology 2. The knowledge gained in a self-designed project or case study focused on the watershed in your local area.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Define the understanding of watershed concepts and characteristics
ii. Write the Research and familiarize yourself with various data collection techniques used in watershed investigation

b. Mini Project

i. Explore online courses on watershed management, hydrology, and related topics offered by educational platforms.

AE 406.2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 To Understand a holistic understanding of the challenges and opportunities Hydrologic. **SO2.2** To the knowledge, skills, and tools necessary to actively contribute to the infiltration **SO2.3** To understand the participants will be better equipped to make informed decisions regarding land use and Runoff. **SO2.4** To participants will be better prepared to incorporate hydrologic considerations into comprehensive watershed discharge rating curve efforts **SO2.5** Participants will be well-prepared to delineate and prioritize watersheds based on Rational method	1- Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records. 2- Exercise on depth - area - duration and double mass curves. 3- Computation of runoff volume by SCS curve number method.	**Unit-2.0** **2.1** Watershed management concept **2.2** watershed planning based on **2.3** land capability classes,	i. Explanation of brief concept of watershed management. ii. Formation of hydrologic data for watershed study.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Draw the watershed stream figure with codification.
ii. Prepare a list of watershed area correction numerical problem and its concept.

AE 406.3: The theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	7	8	2	1	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To understand the basic concept of water budgeting. **SO3.2** Types of structures or accessories used for rain water harvesting. **SO3.3** Knowing the different types of methods of rain water harvesting. **SO3.4** Properties and use recycling. **SO3.5** Properties and stream order techniques.	1. Water budgeting of watersheds. 2. Exercise on frequency analysis of hydrologic data 3. estimation of missing data, test for consistency of rainfall records. 4. Exercise on computation of infiltration indices.	**Unit-3:** Geomorphology of watersheds **3.1** Management measures - rainwater conservation technologies. **3.2** - in-situ and ex-situ storage. **3.3** – Linear, aerial and relief aspects of watersheds.	i. Learn basic specification of water drainage density. ii. Advantages of stream frequency

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. What is drainage density? Explain the different types drainage density techniques with suitable figure.
ii. Explain the various rainwater conservation technologies in detail.
iii.

b. Mini Project:

To identify the water stream order used for urban and rural area.

AE 406.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed hydrology strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	6	2	1	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO4.1 To understand the basic concept of Integrated watershed Hydrograph **SO4.2** Understanding the basic components and various method of watershed Components **SO4.3** Understanding the difficulties occurs in base flow separation. **SO4.4** understand the error in unit hydrograph theory. **SO4.**5 To understand the basic concept S-curve,and knowing the concept of synthetic hydrograph watershed hydrology.	1. - Analysis of hydrologic data for planning watershed management. 2. . Study of watershed Integrated watershed management technologies. 3. Exercise on geomorphic parameters of watersheds.	Unit-4: Integrated watershed management **4.1** Concept, components, watershed management **4.2** Arable lands agriculture and horticulture, **4.3** Brief non-arable lands, forestry, fishery and animal husbandry	i. Preparation of process flow chart of Integrated watershed management operations of agriculture field. ii. Draw a typical cropping pattern map of agriculture India.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Describe the synthetic hydrograph in detail.
   ii. Describe briefly the unit hydrograph theory for watershed management.

d. Mini Project:
   i. To create the elevation difference counter map.

AE 406.5: **Upon completing the course, students should be well-prepared to actively contribute to the. Flood routing planning, execution, and evaluation of Drought management programs, incorporating principles of sustainability, community participation, and effective project management.**

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	3	8	2	1	15

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Overview learning of watershed stream gauging **SO5.2** Over view understating maintenance and flood peak watershed programme **SO5.3** Role of the computation of probable flood and survey. **SO5.4** Overview off computation, drought management strategy. **SO5.5** Basic cost-benefit analysis of watershed drought	1. Exercise on synthetic hydrograph. 2.Exercise on unit hydrograph. 3. Exercise on flood routing. 4. Exercise on flood routing.	**Unit 5 Stream gauging -** 5.1 - discharge rating curves. 5.2 Flood maintenance, monitoring 5.3 Evaluation drainage density and stream frequency	1. To know the maintenance of design flood by theodolite survey. 2. Explore the Planning project proposal for watershed reservoir routing.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- Explain the discharge rating curves for watershed watershed management programme.
- Explain the role of people's participation in watershed management programme.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab (LI)	Sessiona lWork (SW)	Self-Learning (SL)	Total hour (CL+LI+ SW+SL)
AE 406.1: A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to intensity-duration-frequency relationship contribute effectively to sustainable resource hydrology and environmental conservation.	3	4	2	1	10
AE 406.2: Overall, the course should equip students with -discharge rating curve, estimation of peak runoff rate and volume to assess, plan, and manage watersheds sustainably, Runoff, considering the diverse factors that influence their health and productivity.	3	4	2	1	10
AE 406.3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. relief aspects of watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.	3	8	2	1	12
AE 406.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed Hydrograph strategies that consider the diverse needs of the unit hydrograph theory community while maintaining ecological balance stream frequency and sustainability.	3	6	4	2	17
AE 406.5: Upon completing the course, students should be well-prepared to actively contribute to the planning, Flood routing, execution, and evaluation of watershed management programs, incorporating principles of sustainability, Drought, community participation, and effective project management	3	8	2	1	9
Total Hours	**15**	**30**	12	6	63

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Hydrologic cycle	05	01	00	06
CO-2	Hydrologic processes	06	02	01	9
CO-3	Geomorphology of watersheds	06	05	03	14
CO-4	Hydrograph	06	06	02	14
CO-5	Stream gauging	05	02	-	07
Total		28	16	06	50

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

The end of semester assessment for Watershed Hydrology 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
9. Brainstormi

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Hydrology and Soil Conservation Engineering:	Ghanshyam Das. 2008	2nd Edition, Prentice-Hall of India Learning Pvt. Ltd	2nd Edition
2	Soil and Water Conservation and Watershed Management	Mahnot, S.C.	International Books and Periodicals Supply Service. New Delhi	2014
3	Norms For Limestone Exploration For Cement Manufacture	Watershed Managemen t:Design and Practices	E-media Publications, Udaipur.	2000.
4	Watershed Planning and Management	Singh, R.V	Yash Publishing House, Bikaner	2000
5				
6				
7				

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22AE425

Course Title: Watershed Hydrology

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural
CO -1 A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource hydrology and environmental conservation.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO -2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO -3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water hydrology twithin watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO -4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed hydrology strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO -5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed hydrology programs, incorporating principles of sustainability, community participation, and effective project management	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (L I)	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: A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource management and environmental conservation.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	**As Mentioned along with the concern units**	Unit-1.0 Knowledge with practical skills, preparing students to contribute effectively to sustainable resource management 1.1,1.2,1.3	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence 2.1, 2.2, 2.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.	SO31 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3: the complexities of water budgets, be familiar with a range of conservation technologies 3.1, 3.2,3.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed management strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4: Knowledge and skills necessary to plan and implement integrated watershed 4.1, 4.2,4.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed management programs, incorporating principles of sustainability, community participation, and effective project management	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: The students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed 5.1,5.2,5.3	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code: 22AE426

Course Title: Irrigation Engineering

Pre- requisite:

- Basic understanding of hydrology, hydraulics, and soil science.
- Familiarity with basic engineering principles and calculations.

Rationale: This syllabus aims to equip students with the knowledge and skills necessary to design, manage, and operate irrigation systems effectively. Understanding various irrigation methods, water requirements, and soil-water relationships is crucial for maximizing water use efficiency and ensuring sustainable agricultural practices.

Course Outcomes:

AE 407.1: Analyze major irrigation projects (impact, water, use) in India.

AE 407.2: Design & assess water measurement, open channels & on-farm structures.

AE 407.3: Understand underground pipes, design & land grading for water efficiency

AE 407.4: Master soil properties, water movement & measurement for optimal irrigation

AE 407.5: Calculate crop water needs & design surface methods for efficient use

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(PCC)	22AE426	Irrigation Engineering	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	22AE426	**Irrigation Engineering (Theory)**	0	15	15	0	0	30	50	80
		Irrigation Engineering (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 407.1: Analyze major irrigation projects (impact, water, use) in India

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	5	4	2	2	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the types and characteristics of major and medium irrigation schemes in India. **SO1.2** Analyze the purpose and historical development of irrigation projects in the country. **SO1.3** Critically evaluate the environmental impacts of irrigation projects and propose mitigation strategies), **SO1.4** Assess the current status and challenges in utilizing different water resources for irrigation.	**1.** Measurement of soil moisture by different soil moisture measuring instruments **2.** Determination of bulk density, field capacity and wilting point;	**Unit-1.0 Major and Medium Irrigation Schemes in India** **1.1** Major and medium irrigation schemes of India, **1.2** Purpose of irrigation **1.3** Environmental impact of irrigation projects **1.4** Source of irrigation water, **1.5** Present status of development and utilization of different water resources of the country	**1.** Read articles or watch documentaries on specific major or medium irrigation projects in India. **2.** Explore government websites and reports on the current status of water resource development and utilization in India. **3.** Research the environmental impacts of existing irrigation projects and discuss potential mitigation strategies.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Compare and contrast two different types of irrigation schemes (canal, lift, tank, etc.) based on their suitability for specific regions and crops in India.

ii. Analyze data on water use efficiency and environmental impact of different irrigation projects in India and propose potential improvements.

b. Mini Project:

i. Conduct a field visit to a nearby irrigation project and interview farmers or officials about their experiences, challenges, and suggestions for improving water management.

c. Other Activities (Specify):

i. Develop a case study on a specific irrigation project highlighting its history, impact on society and environment, and potential future developments

AE 407.2: Design & assess water measurement, open channels & on-farm structures

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	7	4	2	2	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Apply principles of hydraulics to quantify water flow using weirs, flumes, and orifices. **SO2.2** Design and manage open channel water conveyance systems for efficient water delivery. **SO2.3** Analyze the need and benefits of lining irrigation field channels. **SO2.4** Understand the function and importance of on-farm structures for water control and distribution	**1.** Measurement of irrigation water **2.** Measurement of infiltration characteristics	**Unit-2 Irrigation Water Measurement and Distribution** **2.1** Measurement of irrigation water **2.2** Weir **2.3** Flumes **2.4** Orifices **2.5** Open channel water conveyance system **2.6** Design and lining of irrigation field channels **2.7** On farm structures for water conveyance, control & distribution	**1.** Attend a workshop or take an online course on the principles of flow measurement with weirs, flumes, and orifices. **2.** Research current technologies for water level monitoring and automated irrigation control systems. **3.** Analyze case studies showcasing innovative approaches to improving water conveyance efficiency in open channels.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Calculate the flow rate of water through a given weir or flume based on measured dimensions and upstream water level.

ii. Design a layout for an open channel irrigation system for a specific field, considering topography and water flow requirements.

b. Mini Project:

i. Build a scale model of an irrigation canal or field channel and observe the water flow patterns with different channel lining materials or slopes.

c. Other Activities (Specify):

i. Develop a proposal for implementing smart irrigation technologies (sensors, control systems) in a local agricultural setting

AE 407.3: Understand underground pipes, design & land grading for water efficiency

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	6	4	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Identify and explain the components of underground pipe conveyance systems for irrigation. **SO3.2** Design efficient underground pipe networks for specific field conditions and water requirements. **SO3.3** Apply various criteria for land leveling and choose appropriate design methods. **SO3.4** Estimate earthwork requirements for land leveling projects	**1.** Land grading methods **2.** Design of underground pipeline system	**Unit-3: Underground Pipe Conveyance and Land Grading** **3.1** Underground pipe conveyance system **3.2** Components and design **3.3** Land grading **3.4** Criteria for land levelling **3.5** Land levelling design methods **3.6** Estimation of earth work	**1.** Explore online resources on different types of pipes and materials used in underground irrigation systems. **2.** Research land levelling techniques and equipment used for efficient water distribution and crop production. **3.** Analyze the economic and environmental benefits of using underground pipe conveyance compared to open channels.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Design a network of underground pipes for a specific field, considering water pressure requirements and field layout.

ii. Calculate the amount of earthwork needed for land leveling a field based on its topography and desired slope.

b. Mini Project:

i. Build a mock underground irrigation system with transparent pipes and pressure gauges to visualize water flow and pressure fluctuations.

c. Other Activities (Specify):

i. Conduct a field demonstration of different land levelling techniques and compare their effectiveness and efficiency.

AE 407.4: Master soil properties, water movement & measurement for optimal irrigation

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	6	4	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Explain how different soil properties influence irrigation management decisions. **SO4.2** Analyze soil water movement, infiltration, and potential within the soil profile. **SO4.3** Understand the concept of soil moisture characteristics and key constants. **SO4.4** Measure soil moisture content using various methods and interpret its meaning for plant growth. **SO4.5** Assess the relationship between moisture stress and plant response for different crops.	**1.** Estimation of irrigation efficiency **2.** Study of advance, recession and computation of infiltration opportunity time	**Unit-4: Soil-Water-Plant Relationships** **4.1** Soil properties influencing irrigation management, **4.2** Soil water movement**,** Infiltration **4.3** Soil water potential **4.4** Soil moisture characteristics, Soil moisture constants **4.5** Measurement of soil moisture **4.6** Moisture stress and plant response	**1.** Attend a presentation or take a course on soil properties and their influence on water movement and retention. **2.** Research and compare different methods for measuring soil moisture content. **3.** Analyze case studies exploring the effects of water stress on different crops and its impact on yield.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Analyze soil samples from a field to determine their texture, organic matter content, and infiltration rate.
- **ii.** Estimate the irrigation water requirement for a specific crop based on soil characteristics, climate data, and crop development stage.

b. Mini Project:

- **i.** Monitor soil moisture content in pots planted with different crops using various measurement methods (tensiometers, gravimetric, etc.) and compare their effectiveness.

c. Other Activities (Specify):

- **i.** Design and implement a controlled experiment to study the impact of different irrigation levels on plant growth and yield for a specific crop.

AE 407.5: Calculate crop water needs & design surface methods for efficient use

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	6	6	2	2	24

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Define and calculate evapotranspiration (ET) as a basis for estimating water needs. **SO5.2** Apply different methods to measure and estimate ET rates for specific crops and locations. **SO5.3** Determine the water and irrigation requirements of various crops at different growth stages. **SO5.4** Evaluate the efficiency of different surface irrigation methods like border, check basin, and furrow irrigation. **SO5.5** Design and adapt surface irrigation systems considering field characteristics and crop requirements.	**1.** Infiltration by inflow-outflow method **2.** Evaluation of border irrigation, furrow irrigation, check basin irrigation method. **3.** Estimation of evapotranspiration;	**Unit 5: Crop Water Requirements and Surface Irrigation Methods** **5.1** Water requirement of crops **5.2** Concept of evapotranspiration (ET) and measurement **5.3** Water and irrigation requirement of crops, **5.4** Depth of irrigation, Frequency of irrigation, **5.5** Irrigation efficiencies **5.6** Surface methods of water application Border, check basin and furrow irrigation-adaptability, specification and Design considerations	**1.** Research various methods for estimating evapotranspiration (ET) rates for different crops and locations. **2.** Analyze different border, check basin, and furrow irrigation systems and their suitability for specific crops and soil types. **3.** Explore best practices for designing and managing these surface irrigation methods to improve water use efficiency.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- **i.** Calculate the reference evapotranspiration (ET0) for a specific location and use it to estimate the crop water requirement for a chosen crop.
- **ii.** Design a border, check basin, or furrow irrigation system for a specific field based on crop, soil characteristics, and available water resources.

b. Mini Project:

- **i.** Compare the water application efficiency and crop yield for different surface irrigation methods using controlled field plots.

c. Other Activities (Specify):

1. Develop a water management plan for a local farm, including irrigation scheduling, system maintenance, and strategies for improving water use efficiency.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
AE 407.1: Analyze major irrigation projects (impact, water, use) in India	5	4	2	2	9
AE 407.2: Design & assess water measurement, open channels & on-farm structures	7	4	2	2	11
AE 407.3: Understand underground pipes, design & land grading for water efficiency	6	4	2	2	10
AE 407.4: Master soil properties, water movement & measurement for optimal irrigation	6	4	2	2	10
AE 407.5: Calculate crop water needs & design surface methods for efficient use	6	6	2	2	10
Total Hours	**30**	**22**	**10**	**10**	50

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Major and Medium Irrigation Schemes in India	03	01	01	05
CO-2	Irrigation Water Measurement and Distribution	02	06	02	10
CO-3	Underground Pipe Conveyance and Land Grading	03	07	05	15
CO-4	Soil-Water-Plant Relationships	-	10	05	15
CO-5	Crop Water Requirements and Surface Irrigation Methods	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Irrigation Engg. will be held with writtenexamination 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Krishi Vigyan Kedra
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	Theory and Practice	A.M. Michael	Vikas Publishing House New Delhi	2012
2	Irrigation Water Management Principles	D. K. Majumdar	PHI learning Private Limited New Delhi 2nd Edition	2013
3	Crop Evapotranspiration guidelines for computing crop water requirement. Irrigation and drainage Paper 56,	R. G. Allen, L. S. Pereira, D. Raes, M. Smith.	FAO of United Nations, Rome	1998
4	Land and Water Management Engineering.	VVN Murthy	Kalyani Publishers, New Delhi	2013
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

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Cos, POs and PSOs Mapping

Course Title: B. Tech Agricultural Engineering

Course Code: 22AE426

Course Title: Irrigation Engineering

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Understanding of the concept of fundamentals of digital electronics introducing number system its types and Boolean algebra	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2: Introduction of Combinational logic circuits, Sequential logic circuits and their types.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3: Understanding the concept of Different electronic components and their working principles.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO 4: Master soil properties, water movement & measurement for optimal irrigation	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO 5: Calculate crop water needs & design surface methods for efficient use	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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	CO-1: Analyze major irrigation projects in India	SO1.1 SO1.2 SO1.3 SO1.4	2	Unit-1.0 Major and Medium Irrigation Schemes in India 1.1,1.2,1.3,1.4,1.5	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 2: Design & assess water measurement systems	SO2.1 SO2.2 SO2.3 SO2.4	2	Unit-2 Irrigation Water Measurement and Distribution 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO3: Understand underground pipes & land grading	SO3.1 SO3.2 SO3.3 SO3.4	2	Unit-3 Underground Pipe Conveyance and Land Grading 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4,5	CO 4: Master soil properties for optimized irrigation	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	2	Unit-4 Soil-Water-Plant Relationships 4.1, 4.2,4.3,4.4,4.5,4.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4,5,6	CO 5: Calculate crop water needs & design surface methods	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	3	Unit 5 Crop Water Requirements and Surface Irrigation Methods 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering and Food technology

B.Tech. (Agricultural Engineering) Programme

Semester-IV

Course Code: **22AE427**

Course Title: Sprinkler and Micro irrigation Systems

Pre- requisite: Introductory knowledge of agricultural engineering concepts and knowledge of hydraulics and fluid mechanics

Rationale:

- Sprinkler and micro irrigation systems are becoming increasingly important in modern agriculture due to their water efficiency, precision application, and potential for automation.
- This course equips students with the knowledge and skills necessary to design, implement, and manage these systems effectively, improving agricultural productivity and resource conservation.
- Understanding fertigation techniques allows for precise nutrient delivery alongside irrigation, further optimizing crop growth and reducing environmental impact.

Course Outcomes:

AE 408.1: Analyse adaptability, design, evaluate performance of sprinkler irrigation systems for efficient water management

AE 408.2: Compare micro irrigation systems, design drip systems considering water-soil-plant relationships, optimize water and nutrient delivery

AE 408.3: Master in hydraulics and maintenance of drip systems for efficient operation and longevity

AE 408.4: Evaluate advantages and limitations of fertigation, design effective injection strategies for optimal crop nutrition.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(PCC)	22AE427	Sprinkler and Micro irrigation Systems	1	1	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
PCC	22AE427	**Sprinkler and Micro irrigation Systems (Theory)**	0	15	15	0	0	30	50	80
		Sprinkler and Micro irrigation Systems (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 408.1: Analyse adaptability, design, evaluate performance of sprinkler irrigation systems for efficient water management

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppXHrs.	4	6	2	2	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Identify factors affecting the adaptability of sprinkler irrigation systems **SO1.2** Describe various types of sprinkler irrigation systems **SO1.3** Design a sprinkler irrigation system, including layout selection, hydraulic design, and component selection **SO1.4** Select appropriate pumps and power units for sprinkler irrigation systems **SO1.5** Evaluate the performance of sprinkler irrigation systems using uniformity coefficient and pattern efficiency	**1.** Study of different components of sprinkler irrigation system; **2.** Design and installation of sprinkler irrigation system; **3.** Determination of precipitation pattern,	**Unit-1.0 Sprinkler Irrigation** **1.1** Adaptability, problems and prospects, **1.2** Types of sprinkler irrigation systems performance evaluation of sprinkler irrigation system **1.3** Design of sprinkler irrigation system **1.4** layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps	**1.** Read research articles discussing the adaptability of sprinkler irrigation for different crops and soil types. **2.** Watch online tutorials demonstrating various sprinkler irrigation system types. **3.** Explore websites and case studies highlighting problems and success stories of sprinkler irrigation use.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Compare and contrast two different sprinkler irrigation systems based on their suitability for a specific field and crop.

ii. Design a basic layout for a sprinkler irrigation system on a hypothetical field, considering wind direction and slope.

b. Mini Project:

i. Visit a local farm or nursery using sprinkler irrigation. Interview the owner or manager about their experiences, challenges, and benefits of using the system.

c. Other Activities (Specify):

i. Calculate the water application rate and uniformity coefficient for a given sprinkler system based on manufacturer data and field measurements.

AE 408.2: Compare micro irrigation systems, design drip systems considering water-soil-plant relationships, optimize water and nutrient delivery

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	4	4	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Distinguish between different types of micro irrigation systems (drip, spray, bubbler) **SO2.2** List the merits and demerits of micro irrigation systems **SO2.3** Identify the components of a micro irrigation system **SO2.4** Design a drip irrigation system, considering wetting patterns, irrigation requirements, and emitter selection	**1.** Design and installation of drip irrigation system; **2.** Determination of pressure discharge relationship and emission uniformity for given emitter;	**Unit-2 Micro Irrigation Systems** **2.1** Micro Irrigation System **2.2** Drip, spray, & bubbler systems **2.3** Different components of Micro Irrigation system **2.4** Design of drip irrigation system	**1.** Attend a workshop or webinar on drip, spray, and bubbler irrigation system installation and maintenance. **2.** Analyze online resources comparing the merits and demerits of different micro irrigation types for various crops. **3.** Explore research findings on the impact of emitter selection on plant growth and water use efficiency

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Identify the different components of a drip irrigation system and explain their functions.

ii. Calculate the water requirement for a specific crop and field using evapotranspiration data and crop coefficients.

iii. Design a drip irrigation system layout for a small vegetable garden, considering spacing, emitter flow rates, and piping needs.

b. Mini Project:

i. Conduct a trial experiment comparing the effectiveness of different emitter flow rates on plant growth and water use for a specific crop in pots.

c. Other Activities (Specify):

i. Collaborate with a local farm or nursery to install and monitor a small-scale drip irrigation system, documenting your observations and learnings

AE 408.3: Master in hydraulics and maintenance of drip systems for efficient operation and longevity

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	3	2	2	2	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Explain the hydraulic principles of drip irrigation systems **SO3.2** Describe the steps involved in designing a drip irrigation system **SO3.3** Outline the necessary steps for proper operation and maintenance of a drip irrigation system **SO3.4** Identify common clogging problems and implement appropriate maintenance strategies	**1.** Study of different types of filters and determination of filtration efficiency	**Unit-3: Hydraulics and Maintenance of Micro Irrigation Systems** **3.1** Hydraulics of drip irrigation system **3.2** Necessary steps for proper operation of a drip irrigation system **3.3** Maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment	**1.** Watch online tutorials on hydraulic calculations for drip irrigation systems. **2.** Study case studies showcasing successful maintenance strategies for different micro irrigation systems. **3.** Research current technologies and methods for preventing and addressing clogging problems in drip lines

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Calculate the pressure drop along a drip irrigation lateral considering pipe diameter, length, and emitter flow rates.

ii. Develop a maintenance schedule for a specific drip irrigation system based on manufacturer recommendations and local water quality.

iii. Research and report on innovative approaches for cleaning and treating drip irrigation systems to improve efficiency and lifespan.

b. Mini Project:

i. Build a mock drip irrigation system with transparent tubing and pressure gauges to visualize and measure water flow and pressure variations.

c. Other Activities (Specify):

i. Design and implement a cleaning and flushing procedure for a small drip irrigation system, analyzing its effectiveness in removing sediments and improving water flow.

AE 408.4: Evaluate advantages and limitations of fertigation, design effective injection strategies for optimal crop nutrition

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	4	2	2	2	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Explain the concept of fertigation and its advantages and limitations **SO4.2** Discuss factors affecting fertilizer solubility and compatibility **SO4.3** Identify precautions for successful fertigation systems **SO4.4** Determine fertigation frequency, duration, and injection rates **SO4.5** Describe various methods of fertigation	**1.** Determination of rate of injection and calibration for chemigation/fertigation	**Unit-4: Fertigation** **4.1** Fertilizers solubility and their compatibility **4.2** Precautions for successful fertigation system **4.3** Fertigation frequency, duration and injection rate **4.4** Methods of fertigation	**1.** Attend a presentation or workshop on fertigation techniques and best practices. **2.** Research the compatibility and solubility of common fertilizers used in fertigation systems. **3.** Analyze case studies exploring the economic and environmental benefits of fertigation compared to conventional fertilization methods.

SW-4 Suggested Sessional Work (SW):

d. Assignments:

i. Attend a presentation or workshop on fertigation techniques and best practices.
ii. Research the compatibility and solubility of common fertilizers used in fertigation systems.
iii. Analyze case studies exploring the economic and environmental benefits of fertigation compared to conventional fertilization methods.

e. Mini Project:

i. Monitor and compare the growth and yield of plants in controlled environments irrigated with and without fertigation, analyzing the impact on nutrient uptake and resource use efficiency.

f. Other Activities (Specify):

i. Develop a cost-benefit analysis for implementing fertigation in a specific agricultural context, considering initial investment, fertilizer costs, and potential yield improvements.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
AE 408.1: Analyze adaptability, design, evaluate performance of sprinkler irrigation systems for efficient water management	**4**	**3**	**2**	**2**	**11**
AE 408.2: Compare micro irrigation systems, design drip systems considering water-soil-plant relationships, optimize water and nutrient delivery	**4**	**2**	**2**	**2**	**10**
AE 408.3: Master in hydraulics and maintenance of drip systems for efficient operation and longevity	**3**	**1**	**2**	**2**	**8**
AE 408.4: Evaluate advantages and limitations of fertigation, design effective injection strategies for optimal crop nutrition	**4**	**1**	**2**	**2**	**9**
Total Hours	**15**	**7**	**8**	**8**	**45**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Sprinkler Irrigation**	03	01	01	05
CO-2	**Micro Irrigation Systems**	02	06	02	10
CO-3	**Hydraulics and Maintenance of Micro Irrigation Systems**	03	07	05	15
CO-4	**Fertigation**	-	10	05	15
Total		11	26	13	50

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

The end of semester assessment for Sprinkler and Micro Irrigation Systems 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Krishi Vigyan Kedra
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	Principles of Sprinkler Irrigation systems	M.S Mane and B.L. Ayare	Jain Brothers	2007
2	.Principles of Drip Irrigation systems	M.S Mane and B.L. Ayare. and S.S Magar	Jain Brothers	2006
3	Design and evaluation of irrigation methods, (IARI Monograph No.1).	AM Michael,Shrimohan andb KR Swaminathan	Water Technology Centre, IARI New Delhi	1996
4	Irrigation: Theory and Practice.	A.M. Michael	Vikas Publishings House New Delhi.	2012
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22AE427

Course Title: Sprinkler and Micro Irrigation Systems

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE 408.1: Analyze adaptability, design, evaluate performance of sprinkler irrigation systems for efficient water management	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
AE 408.2: Compare micro irrigation systems, design drip systems considering water-soil-plant relationships, optimize water and nutrient delivery	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
AE 408.3: Master in hydraulics and maintenance of drip systems for efficient operation and longevity	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
AE 408.4: Evaluate advantages and limitations of fertigation, design effective injection strategies for optimal crop nutrition	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2

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	AE 408.1: Analyze adaptability, design, evaluate performance of sprinkler irrigation systems for efficient water management	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	5	Unit-1.0 Sprinkler Irrigation 1.1,1.2,1.3,1.4	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	AE 408.2: Compare micro irrigation systems, design drip systems considering water-soil-plant relationships, optimize water and nutrient delivery	SO2.1 SO2.2 SO2.3 SO2.4	2	Unit-2 Micro Irrigation Systems 2.1, 2.2, 2.3, 2.4	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	AE 408.3: Master in hydraulics and maintenance of drip systems for efficient operation and longevity	SO3.1 SO3.2 SO3.3 SO3.4	1	Unit-3 Hydraulics and Maintenance of Micro Irrigation Systems 3.1, 3.2,3.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2	AE 408.4: Evaluate advantages and limitations of fertigation, design effective injection strategies for optimal crop nutrition	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	3	Unit-4 Fertigation 4.1, 4.2,4.3,4.4	

AKS UNIVERSITY, SATNA
Faculty of Agriculture Science and Technology
Department of Agriculture Engineering and Food technology

B.Tech. (Agricultural Engineering) Programme
Semester-IV

Course Code:	22EE428
Course Title:	**Fundamentals of Renewable Energy Sources**
Pre-requisite:	Student should have basic knowledge about solar energy conversion, wind energy conversion, bio-energy, and biogas generation technologies.
Rationale:	This course explores various renewable energy sources (RES), their potential, limitations, and conversion technologies. It covers solar, wind, geothermal, biomass, and ocean energy sources, comparing them with non-renewable options.

Course Outcomes:

AE409.1: Understand concepts, limitations, and classification of renewable energy sources. Compare them with non-renewable sources.

AE409.2: Analyze solar energy potential, conversion technologies (thermal & photovoltaic), and economic considerations.

AE409.3: Explain wind energy principles, wind turbine types, power generation, and wind farm operation.

AE 409.4: Explore bio-energy via biomass conversion, gasification, biogas production, and utilization technologies.

Scheme of Studies:

Board of Study	Course Code	CourseTitle	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	**LI**	**SW**	**SL**	**Total Study Hours (CI+LI+SW+SL)**	
Program Core PCC	22EE428	Drainage Engineering	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 ofteacher 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)
			Assignments	Mid term1	Mid term2	Class Attendance	Activity	Total Marks		
BSC	22EE428	Renewable Power Sources	0	15	15	0	0	30	50	80
			10	0	0	5	5	**20**	**0**	**20**
										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.

AE 409.1: Understand the fundamentals of drainage, identify drainage problems, and design surface drainage systems.

ApproximateHours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	4	4	2	2	12

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Explain the concept and limitations of different Renewable Energy Sources (RES). **SO1.2** Identify the criteria for assessing the potential of RES **SO1.3** Classify renewable energy sources and analyze their characteristics	**1.** To Study about different types of solar cookers **2.** To Study about solar water heating system	**Unit-1.0 Introduction to Renewable Energy Sources** **1.1** Concept and limitation of Renewable Energy Sources (RES) **1.2** Criteria for assessing the potential of RES **1.3** Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources **1.4** Comparison of renewable energy sources with non-renewable sources.	**1.** Research the definition, types, and working principles of various renewable energy sources (solar, wind, geothermal, biomass, and ocean) **2.** Explore criteria for assessing the potential of RES (availability, cost, environmental impact).

SW-1 Suggested Sessional Work (SW)

Assignments:

i. Compare two renewable energy sources (e.g., solar vs. wind) based on their advantages, disadvantages, and suitability for different locations.

Mini Project:

i. Prepare a chart of renewable energy potential in India.

Other Activities (Specify):

AE409.2: Analyze solar energy potential, conversion technologies (thermal & photovoltaic), and economic considerations.

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	9	10	2	2	23

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Estimate the energy available from the sun and its impact on renewable energy **SO2.2** Analyze the importance of solar radiation data for solar energy applications **SO2.3** Describe the principles of flat plate and concentrating collectors for solar thermal conversion **SO2.4** Explain the operation of different solar thermal devices **SO2.5** Compare natural and forced convection drying systems **SO2.6** Distinguish between standalone and grid-connected solar power stations	**1.** To study about natural convection solar dryer, **2.** To study about forced convection solar dryer, **3.** To study about solar desalination unit **4.** To study about solar greenhouse for agriculture production **5.** Study of Solar photovoltaic system	**Unit-2 Solar Energy & its applications** **2.1** Energy available from Sun **2.2** Solar radiation data **2.3** solar energy conversion into heat through **2.4** Flat plate and Concentrating collectors **2.5** Different solar thermal devices **2.6** Principle of natural and forced convection drying system **2.7** Solar Photo voltaic: p-n junctions. Solar cells, PV system **2.8** Stand alone, Grid connected solar power station **2.9** Calculation of energy through photovoltaic power generation and cost economics.	**1.** Learn the principles of solar energy conversion into heat through flat plate collectors and concentrating collectors (e.g., parabolic troughs). **2.** Explore different solar thermal devices like solar water heaters, cookers, and dryers.

SW-1 Suggested Sessional Work (SW)

Assignments:

i. Obtain historical solar radiation data for your region and analyze its seasonal variations.

ii. Design a simple solar application for your home, like a solar water heater or phone charger, and explain the working principle.

Mini Project:

i. Construct a simple solar box cooker using readily available materials and test its effectiveness in cooking food.

Other Activities (Specify):

i. Develop a scale model of a house that incorporates passive solar design principles for heating and lighting.

AE409.3: Explain wind energy principles, wind turbine types, power generation, and wind farm operation.

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	7	4	2	2	15

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO3.1: Calculate the wind energy available at a specific location **SO3.2**: Explain the concepts of lift and drag as they relate to wind energy conversion. **SO3.3**: Analyze the impact of density, frequency variances, angle of attack, and wind speed on wind energy conversion. **SO3.4**: Describe different types of windmill rotors and their characteristics **SO3.5**: Calculate the torque coefficient of a wind turbine rotor	**1.** To study about different type of wind mill **2.** Numerical to calculate wind power, torque generated by wind mill	**Unit-3: Wind Energy & its applications** 3.1 Energy available from wind 3.2 General formula Lift and drag Basis of Wind energy conversion 3.3 Effect of density, Frequency variances 3.4 Angle of attack, Wind speed 3.5 Types of Windmill rotors 3.6 Determination of torque coefficient, Induction type generators 3.7 Working principle of wind power plant.	**1.** Explore the working principle of wind energy conversion and the effect of wind characteristics on power output. **2.** Research different types of wind turbine rotors and their characteristics.

Suggested Sessional Work (SW):

Assignments:

i. Analyze wind speed data for a specific location and evaluate its suitability for wind energy generation.

ii. Research different wind turbine blade designs and propose an innovative design for improved efficiency.

Mini Project:

i. Deconstruct a small wind turbine model using recycled materials and test its functionality under simulated wind conditions.

ii. Other Activities (Specify):

i. Research and analyze a real-world wind power plant project. Evaluate its technical aspects, economic feasibility, and environmental impact

AE 409.4: Explore bio-energy via biomass conversion, gasification, biogas production, and utilization technologies.

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	10	6	2	2	20

Session Outcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (S)**
SO4.1 Explain the concept of biomass gasification and its applications **SO4.2** Evaluate various types of biomasses cook stoves for rural energy needs **SO4.3** Explain different types of biogas plants and their operation **SO4.4** Discuss design considerations for biogas plants **SO4.4** Evaluate the advantages and disadvantages of biogas spent slurry	**1.** Study of different types Biogas plants, **2.** Study of different types Biomass gasifiers, **3.** Study of Biomass improved cook-stoves	**Unit-4: Bio-energy & its applications** **4.1** Pyrolysis of Biomass to produce solid, liquid and gaseous fuels vertical drainage **4.2** Biomass gasification **4.3** Types of gasifiers **4.4** Various types of biomasses cook stoves for rural energy need. **4.5** Introduction to Biogas **4.6** types of biogas plants **4.7** Biogas generation technology **4.8** factors affecting biogas generation **4.9** Design consideration of biogas **4.10** Advantages and disadvantages of biogas spent slurry.	**i.** Study the process of pyrolysis (thermochemical decomposition) of biomass to produce solid (biochar), liquid (bio-oil), and gaseous fuels (syngas). **ii.** Understand the concept of biomass gasification and various types of gasifiers (fixed bed, fluidized bed, entrained bed) used to convert biomass into syngas.

SW-4Suggested Sessional Work (SW):

Assignments:

i. Analyze wind data for a specific location to determine its suitability for wind energy generation. Consider factors like average wind speed and consistency.

ii. Explore resources like wind resource maps provided by government agencies or renewable energy companies.

Mini Project:

i. Use software or online tools to simulate the performance of a wind turbine under varying wind conditions and calculate power output.

Other Activities (Specify):

i. Analyze the impact of different blade designs and rotor sizes.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Lab Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
AE 409.1: Understand the fundamentals of drainage, identify drainage problems, and design surface drainage systems.	4	4	2	2	12
AE 409.2: Comprehend the principles of subsurface drainage, investigate design parameters, and derive drain spacing equations.	9	10	2	2	23
AE 409.3: Design subsurface drainage systems, select appropriate drainage materials and pipes, and implement layout, construction, and installation techniques.	7	4	2	2	15
AE 409.4: Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance	10	6	2	2	20
Total Hours	30	24	8	8	70

Suggestion for End Semester Assessment

Suggested Specification Table (ForESA)

CO	Unit Titles	MarksDistribution			Total Marks
		R	U	A	
CO-1	**Introduction to Renewable Energy Sources**	03	01	01	05
CO-2	**Solar Energy & its applications**	02	06	02	10
CO-3	**Wind Energy & its applications**	03	07	05	15
CO-4	**Bio-energy & its applications**	-	10	05	15
Total		11	26	13	50

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

The end of semester assessment for fundamental of renewable energy sources 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to solar power plant
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	Non-Conventional Energy Sources	G.D. Rai	Khanna Publishers, Delhi.	2013
2	Solar Energy Utilization	G.D. Rai	Khanna Publishers, Delhi.	
3	Biogas Technology- A Practical Handbook	K.C. Khandelwal, & S. S. Mahdi	Tata McGraw-Hill	1990
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering

Course Code: 22EE428

Course Title: Fundamentals of Renewable Energy Sources

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE409.1: Understand concepts, limitations, and classification of renewable energy sources. Compare them with non-renewable sources.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
AE409.2: Analyze solar energy potential, conversion technologies (thermal & photovoltaic), and economic considerations.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
AE409.3: Explain wind energy principles, wind turbine types, power generation, and wind farm operation.	3	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
AE 409.4: Explore bio-energy via biomass conversion, gasification, biogas production, and utilization technologies.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2

Legend: 1–Low, 2–Medium, 3–High

Course Curriculum Map:

POs&PSOsNo.	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 PSO1,2,3,4	AE409.1: Understand concepts, limitations, and classification of renewable energy sources. Compare them with non-renewable sources.	SO1.1 SO1.2 SO1.3 SO1.4	LI 1.1 LI 1.2	Unit-1.0 Introduction to Renewable Energy Sources 1.1,1.2,1.3,1.4	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	AE409.2: Analyze solar energy potential, conversion technologies (thermal & photovoltaic), and economic considerations.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6	LI 2.1 LI 2.2 LI 2.3 LI 2.4 LI 2.5	Unit-2 Solar energy & its application 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4	AE409.3: Explain wind energy principles, wind turbine types, power generation, and wind farm operation.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI 3.1 LI 3.2	Unit-3: Wind energy & its applications 3.1,3.2,3.3,3.4,3.5,3.6,3.7	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	AE 409.4: Explore bio-energy via biomass conversion, gasification, biogas production, and utilization technologies.	SO4.1 SO4.2 SO4.3 SO4.4	LI 4.1 LI 4.2 LI 4.3	Unit-4: Bio-energy & its applications 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9, 4.10	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-V

Course Code:	22AE521
Course Title :	**Tractor Systems and Controls**
Pre- requisite:	Student should have basic knowledge of tractor and its components, tractor terminology and application of tractor.
Rationale:	The students studying agricultural engineering should possess foundational understanding about role of tractor in modern farming, performing various tasks such as plowing, planting, cultivating, and harvesting. This encompasses familiarity with different tractor system, power outlets from tractor and mechanics of tractor. Additionally, students ought to acquire fundamental insights ergonomics of tractor and testing standards of tractor.

Course Outcomes:

AE 501.1: Students understand tractor transmission system, need, function, types, construction and working principle of different types of clutch.

AE 501.2: Students acquire the knowledge about working principle of gear box, differential system of tractor and braking mechanism.

AE 501.3: Students acquire a comprehensive understanding of the principles, components, and functioning of steering systems of tractor as well as hydraulic system.

AE 501.4: Students enhancing the knowledge about tractor power outlets, traction and function of tire and its construction.

AE 501.5: Students gain the knowledge about tractor mechanics, deciphering the engine test codes, ergonomically and safety considerations in Tractor.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week) CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	Total Credits(C)
Program Core (PCC)	22AE521	Tractor Systems and Controls	3	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks) Progressive Assessment (PRA) Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
PCC	22AE521	**Tractor Systems and Controls (Theory)**	0	15	15	0	0	30	50	80
		Tractor Systems and Controls (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 501.1: Students understand tractor transmission system, need, function, types, construction and working principle of different types of clutch.

Approximate Hours

Item	AppX Hrs
CL	5
LI	4
SW	1
SL	2
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO1.1 Understand how to transmit the power in tractor **SO1.2** Students gain knowledge about need and function of clutch **SO1.3** Students understand features ,construction and different type of clutch **SO1.4** student gain knowledge and uses of different type of clutch **SO1.5** Students Solve the numerical problems related to clutch .	1.1 Introduction to transmission systems and components in practical lab. 1.1 Demonstrate of clutch functioning, parts in laboratory and design problem on clutch system.	**Unit-1.0 Power transmission system and clutch.** 1.1 Need of power transmission system and power train of tractor. 1.2 Need of clutch, functional requirement and types of clutch. 1.3 Construction of clutch and working principle of clutch. 1.4 Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. 1.5 Determine the power and torque required for clutch.	1.1 Construction detail and working principle of single plate clutch system 1.2 Design of clutch for uniform pressure theory and uniform wear theory

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Draw neat and clean diagram of single plate clutch and explain the working principles of clutch.

b. Mini Project:

i. Derivation for uniform pressure theory and uniform wear theory and numerical related to clutch

c. Other Activities (Specify):

Prepare chart for different type of clutch

AE 501.2: Students acquire the knowledge about working principle of gear box, differential system of tractor and braking mechanism.

Approximate Hours

Item	AppX Hrs
CL	7
LI	6
SW	2
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Students learn about gearing theory and its principle **SO2.2** To understand the Gear box, types and functional requirement **SO2.3** Students Solve the numerical problems related to speed reduction **SO2.4** To gain the knowledge about differential system and construction details **SO2.5** To lean about Brake system , principle of operation and construction details	2.1 Study of different types of gear box, calculation of speed ratios, design problems on gear box 2.2 Study on differential and final drive and planetary gears 2.3 Study of brake systems and some design problems	**Unit-2 Gearbox and brake system of tractor** 2.1 Gearing theory and principle of operation 2.2 Gear box, types and functional requirement 2.3 calculation for speed ratio 2.4 Study of differential system – need, functional components and construction 2.5 calculation for speed reduction 2.6 Study of Brake system – types, principle of operation and construction details 2.7 Calculation for braking torque.	2.1 Numerical problems related to gearbox and differential system

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Prepare trouble-Shooting chart of gear box
ii. Prepare at least 20 objectives question related to gear box and differential system.

b. Mini Project:

i. Collect the previous gate numerical question related to gear box and solve it.

c. Other Activities (Specify):
Enlist the make and models of different tractor companies use the synchronous type gear box.

AE 501.3: Students acquire a comprehensive understanding of the principles, components, and functioning of steering systems of tractor as well as hydraulic system.

Approximate Hours

Item	AppX Hrs
CL	6
LI	4
SW	2
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (S)
SO3.1 Student understand the steering mechanism and its geometry **SO3.2** Students learn steering components and its function **SO3.3** To gain the knowledge about Ackerman steering system and Steering systems in track type tractors **SO3.4** To lean about Hydraulic system in a tractor **SO3.**5 Students know the uses of ADDC with different implements.	3.1 To study about Steering geometry and adjustments. 3.2 To study about hydraulic systems in a tractor and some design problems	**Unit-3 : Steering system and hydraulic system of tractor** 3.1 Study of steering system – requirements, steering geometry characteristics, 3.2 functional components and calculation for turning radius 3.3 Familiarization with Ackerman steering and Steering systems in track type tractors 3.4 Hydraulic system in a tractor – Principle of operation, types, 3.5 Functional components of hydraulic system 3.6 Familiarization with the Hydraulic system adjustments and ADDC.	3.1 Draw a neat and clean diagram of steering mechanism and explain its components 3.2 Draw a neat and clean diagram of hydraulic system of tractor and explain the components

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Draw neat and clean diagram of steering system and explain the components.
ii. Draw neat and clean diagram of hydraulic system and explain the components.

b. Mini Project:

i. Prepare the chart about different steering gears used in tractor.

c. Other Activities (Specify):

i. Prepare trouble-Shooting chart for manual steering and power steering system

AE 501.4: Students enhancing the knowledge about tractor power outlets, traction and function of tire and its construction.

Approximate Hours

Item	AppX Hrs
CL	6
LI	2
SW	2
SL	1
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Understanding the different power outlets of tractor. **SO4.2** Understanding the Traction and its terminology **SO4.3** Students calculate shear force and rolling resistance on traction device **SO4.4** Students know the function and constructional details of tyre **SO4.5** Gain the knowledge about improvements of traction in tractor	4.1Determination of Traction performance of a traction wheel.	**Unit-4: Tractor power outlets and Traction** 4.1 PTO. PTO standards, types and functional requirements 4.2 Introduction to Traction and terminology 4.3 Theoretical calculation of shear force and rolling resistance on traction device 4.4 Wheels and tyres- Tyre terminology and function of tyre 4.5 tyre construction and their specifications 4.6 Study of traction aids	i. Solve the numerical related to traction and rolling resistance

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Explain the traction theory and rolling resistance
   ii. Draw neat and clean diagram of pneumatic tyre constriction and explain its components

b. **Mini Project:**
   i. Visit to tractor lab and indentify the tractor tyre size, ply rating also see the effect of too ballasting on tractor performance

c. **Other Activities (Specify):**
   i. Prepare the chart of different companies who makes the tractor tyre with their cost

.**AE 501.5**: **Students gain the knowledge about tractor mechanics, deciphering the engine test codes, ergonomically and safety considerations in Tractor**

Approximate Hours

Item	AppX Hrs
CL	6
LI	6
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1 understating the forces acts on tractor and stability of tractor at equilibrium condition **SO 5.2** Student understand the moment of inertia of a tractor **SO 5.3** Students know the methods to determine the CG of tractor **SO 5.4** Gain the knowledge about ergonomics consideration for design. **SO 5.**5 understanding the tractor testing codes and procedure	5.1 Determination of location of CG of a tractor 5.2 Determination of Moment of Inertia of a tractor 5.3 Appraisal of various controls in different makes tractors in relation to anthropometric measurements	**Unit 5: Tractor Mechanics and ergonomic considerations** 5.1 Forces acting on the tractor and Study of tractor static equilibrium. 5.2 Determination and importance of moment of inertia of a tractor 5.3 Determination of maximum drawbar pull and determination of CG of a tractor 5.4 Familiarization with tractor as a spring-mass system 5.5 Ergonomic considerations and operational safety 5.6 Introduction to tractor testing	i. Explain the weighing methods to determine the CG of tractor ii. Explain the stability of tractor specially at turns.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Draw the free body diagram of tractor and determine the weight transfer
ii. Enlist the IS code for tractor testing

.

b. Mini Project:

i. Visit to tractor lab and measure the wheel base and track with of tractor.

c. Other Activities (Specify):
Enlist and write the technical terms used in testing

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE 501.1: Students understand tractor transmission system, need, function, types, construction and working principle of different types of clutch.	5	4	1	2	12
AE 501.2: Students acquire the knowledge about working principle of gear box, differential system of tractor and braking mechanism.	7	6	2	1	16
AE 501.3: Students acquire comprehensive understanding of the principles, components, and functioning of steering systems of tractor as well as hydraulic system.	6	4	2	2	14
AE 501.4: Students enhancing the knowledge about tractor power outlets, traction and function of tire and its construction.	6	2	2	1	11
AE 501.5: Students gain the knowledge about tractor mechanics, deciphering the engine test codes, ergonomically and safety considerations in Tractor.	6	6	2	2	16
Total Hours	30	22	9	8	69

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Power transmission system and clutch.	02	02	01	05
CO-2	Gearbox and brake system of tractor	02	06	02	10
CO-3	Steering system and hydraulic system of tractor	03	07	05	15
CO-4	Tractor power outlets and Traction	-	10	05	15
CO-5	Tractor Mechanics and ergonomic considerations	02	02	01	05
Total		09	27	14	50

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

The end of semester assessment for Tractor System and Control 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit tractor workshop and understand about tractor
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	Automobile Engineering	Dr. D.S.Kumar	S.K. Kataria & Sons, Publisher of engineering and computer books	Second Edition, revised and update 2018
2	Elements of Agricultural Engineering	Dr. Jagdiswar Sahay	Standard Publisher Distributors	Fifth Edition 2013
3	Tractor and Their Power Units	Jhon B. Liljedahal Paul K. Turnquist David W. Smith Makoto Hoki	National Council for Cement and Building Materials	Fourth Indian Edition 1997
4	Automobile Engineering Vol-1	Kripal Singh	Standard Publisher Distributors	2020
5	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. (Agricultural Engineering)
Course Code: 22AE521
Course Title: Tractor Systems and Controls

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Students understand tractor transmission system, need, function, types, construction and working principle of different types of clutch.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Students acquire the knowledge about working principle of gear box, differential system of tractor and braking mechanism.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3 : Students acquire comprehensive understanding of the principles, components, and functioning of steering systems of tractor as well as hydraulic system.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Students enhancing the knowledge about tractor power outlets, traction and function of tire and its construction.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO 5: Students gain the knowledge about tractor mechanics, deciphering the engine test codes, ergonomically and safety considerations in Tractor.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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: Students understand tractor transmission system, need, function, types, construction and working principle of different types of clutch.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI 1.1 LI 1.2	Unit-1.0 Power transmission system and clutch 1.1,1.2,1.3,1.4,1.5	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO-2: Students acquire the knowledge about working principle of gear box, differential system of tractor and braking mechanism..	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI 2.1 LI 2.2 LI 2.3	Unit-2 Gearbox and brake system of tractor gearbox and brake system of tractor 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO-3: Students acquire a comprehensive understanding of the principles, components, and functioning of steering systems of tractor as well as hydraulic system	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI 3.1 LI 3.2	Unit-3 : Steering system and hydraulic system of tractor 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Students enhancing the knowledge about tractor power outlets, traction and function of tire and its construction.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI 4.1	Unit-4 : Tractor power outlets and Traction 4.1, 4.2, 4.3, 4.4, 4.5, 4.6.	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Students gain the knowledge about tractor mechanics, deciphering the engine test codes, ergonomically and safety considerations in Tractor.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI 5.1 LI 5.2 LI 5.3	Unit 5: Tractor Mechanics and ergonomic considerations 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme
Semester-V

Course Code:	22AE522
Course Title:	**Farm machinery and power engineering**
Pre-requisite:	Student should have basic knowledge of Farm machinery and equipment and tractor control system
Rationale:	The students studying agricultural engineering should possess foundational understanding about farm machinery and power engineering combine to enhance agricultural efficiency, automating tasks, reducing labor dependency, and ensuring timely operations. This integration fosters economic viability, technological innovation, and adaptability, ultimately contributing to sustainable and productive farming practices.

Course Outcomes:

AE 502.1: Understand the classification criteria for various farm machines and evolution of farm mechanization.

AE 502.2: Understand hitching systems and control mechanisms of farm machinery.

AE 502.3: Students understands about tillage equipments and its uses, students calculate required draft power.

AE 502.4: Assess field efficiency through the calculation of field capacities.

AE 502.5: Students gain the knowledge to select and optimize materials and heat treatment processes for designing and building durable and functional agricultural machinery.

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 (CI+LI+SW+SL)	
Program Core (PCC)	**22AE522**	**Farm machinery and power engineering**	5	2	1	1	9	3

Legend: **CI:** Class room 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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	22AE522	**Farm machinery and power engineering (Theory)**	0	15	15	0	0	30	50	80
		Farm machinery and power engineering (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 502.1: Introduction to farm mechanization, Classification of farm machines or selection of machines

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	6	1	2	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Farm mechanization involves the use of machinery and technology to perform agricultural tasks, increasing efficiency and productivity on the farm. It includes the adoption of tractors, harvesters, and other equipment to streamline traditional farming processes **SO1.2** Hitching systems include drawbars; three-point hitches operational controls manage speed, depth, and application rates, enhancing efficiency in diverse agricultural activities.	1. Familiarization with different farm implements and tools. 2. Hitching systems and controls of farm machinery 3. Problems on machinery management.	**Unit-1.0 Introduction to farm mechanization** 1.1 Introduction to farm mechanization. 1.2 Classification of farm machines. 1.3 Unit operations in crop production. 1.4 Identification and selection of machines for various operations on the farm. 1.5 Hitching systems and controls of farm machinery. 1.6 Calculation of field capacities and field efficiency.	1. Learn about different tractor control system. 2. Mathematical calculation about actual field capacity and theoretical field capacity

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Evaluate safety measures associated with hitching systems and control mechanisms.

b. **Mini Project:**

Design and present a comprehensive project outlining a farm mechanization plan for a hypothetical farm, considering various factors for maximum efficiency.

AE 502.2: Acquire knowledge regarding the Agricultural Machinery Economics, Seed-Bed Preparation, and Land Reclamation.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	5	4	1	1	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Evaluate formulas for calculating the cost of machinery ownership **SO2.2** Understand the factors influencing the economic decisions between owning and hiring machinery. **SO2.3**Understand the concept of seed-bed preparation. **SO2.4**Familiarize oneself with various earth-moving equipment and their applications.	1. Numerical for cost analysis of tractor. 2. Cost analysis of matching implements	**Unit-2** Economic Analysis of farm machineries 2.1 Calculations for economics of tractor usage. 2.2 Calculations for economics of machinery usage. 2.3 comparison of ownership with hiring of machines 2.3Introduction to seed-bed preparation and its classification 2.4Familiarization with land reclamation and earth moving equipment.	1.learning to comparison of ownership with hiring of machines

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. solve practical problems involving machinery economics, showcasing scenarios where ownership or hiring is the more cost-effective option

b. Mini Project:

i. Develop a detailed tillage plan for a specific crop, outlining the selection of appropriate techniques and machinery. Present the plan with supporting justifications.

c. Other Activities (Specify):

Create a visual presentation introducing land reclamation, highlighting the role of earth-moving equipment, and explaining their specific applications in agriculture.

AE 502.3: Students understands about tillage equipments and its uses, students calculate required draft power.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	6	6	2	2	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 Students understand about the tillage equipments **SO3.2** Understand and apply measurements of draft in tillage tools. **So3.4** Analyze and identify major functional components within tillage machinery, demonstrating a deeper understanding of the inner workings of these tools. **So3.5** Evaluate and customize attachments for tillage machinery, demonstrating creativity and practical skills in enhancing machinery versatility.	1. To Study of primary tillage machinery 2. To Study of secondary tillage machinery 3. Calculations of power and draft requirements.	**Unit-3: Introduction to tillage equipments** **3.1** Introduction to machines used for primary tillage and secondary tillage. **3.2** Rotary tillage, deep tillage and minimum tillage. **3.3** Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. **3.4** Introduction to tillage machines like mould-board plough. **3.5** Disc plough, chisel plough. **3.6** Identification of major functional components attachment with tillage machine.	1. Learn about different type of tillage methods and equipment. **2.** Advanced Tillage Techniques and Machinery

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**

i. Practical assessment on operating tillage machinery and applying attachments.

ii. Tillage techniques, measurements, and machinery identification.

b. **Mini Project:**

i. Develop a farm-specific tillage plan, outlining strategies for machinery selection and tillage methods to achieve optimal results with minimal environmental impact.

c. **Other Activities (Specify):**

Analyze case studies of farms implementing different tillage methods and machines, providing insights into their effectiveness and potential improvements.

AE 502.4:Precision Sowing and Planting Techniques in Agriculture

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	5	6	2	1	10

Session Out comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 understands the fundamental concepts of sowing, planting, and transplanting, equipment. **SO4.** Understanding and learn about different tillage practices. **SO4.3** Apply knowledge of furrow openers and metering systems in drills and planters, **SO4.4** Analyze the calibration of seed drills and planters, evaluating the precision of seed placement	1.To Study about sowing and planting equipment 2.Calibration and adjustment of seed drill 3.To Study about transplanter	**Unit-4 :Introduction to sowing equipments** 4.1 Introduction to sowing, planting & transplanting equipment. 4.2 Introduction to seed drills, no-till drills, and strip-till drills. 4.3 Introduction to planters, bed-planters and other planting equipment. 4.4 Study of types of furrow openers and metering systems in drills and planters. 4.5 Calibration of seed-drills/ planters. Adjustments during operation.	Learn about sowing, planting equipment.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Create a detailed tillage plan for a specific crop, outlining the selection of appropriate techniques and machinery. Present the plan with supporting justifications.

2. Engage in practical exercises, measuring draft forces and calculating power requirements for specific tillage tools and machines.

b. Mini Project: Students design a project outlining strategies for the effective use, calibration, adjustment of sowing and planting equipment.

c. Other Activities (Specify):

1. Engage students in a discussion comparing and contrasting the features and applications of different sowing and planting equipment.

AE 502.5: Students gain the knowledge to select and optimize materials and heat treatment processes for designing and building durable and functional agricultural machinery

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	5	6	1	1	10

Session Out comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1.Understand the significance of heat treatment processes in enhancing the properties of materials used in farm machinery. **SO5.2**.Basic concepts of heat treatment processes and their relevance in agricultural machinery. **SO5.3** understanding of heat treatment processes to specify requirements for agricultural machinery components. **SO5.4**Evaluate the suitability of steels and alloys for specific agricultural applications.	1.Identification of materials of constructio in agricultural machine 2.Study of material properties 3. Study of heat treatment processes subjected to critical components of agricultural machinery. .	Unit 5**Introduction to materials & treatments** **5.1** Introduction to materials used in construction of farm machines. **5.2** Heat treatment processes and their requirement in farm machines. **5.3** Properties of materials used for critical and functional components of agricultural machines. **5.4** Introduction to steels and alloys for agricultural application. **5.5** Identification of heat treatment processes specially for the agricultural machinery components.	1. Learn about to identify suitable materials for critical and functional components in agricultural machines.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Write a critical review assessing the performance of different steels and alloys in agricultural machinery.

b. **Mini Project:**
   Create a material and heat treatment strategy for a hypothetical agricultural machine, detailing the selection of materials and specific heat treatment processes for critical components.

c. **Other Activities (Specify):** Presentation explaining the importance of heat treatment in enhancing material properties for agricultural machinery.

Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (CL)	Lab Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (Cl+SW+Sl)
AE 502.1: Understand the classification criteria for various farm machines and evolution of farm mechanization.	6	6	1	2	15
AE 502.2: Understand hitching systems and control mechanisms of farm machinery.	5	4	1	1	11
AE 502.3: Students understands about tillage equipments and its uses, students calculate required draft power.	6	6	2	2	16
AE 502.4: Assess field efficiency through the calculation of field capacities.	5	6	2	1	14
AE 502.5: Students gain the knowledge to select and optimize materials and heat treatment processes for designing and building durable and functional agricultural machinery.	5	6	1	1	13
Total Hours	27	28	7	7	69

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to farm mechanization	03	01	01	05
CO-2	Economic Analysis of farm machineries	02	06	02	10
CO-3	Introduction to tillage equipments	03	07	05	15
CO-4	Introduction to sowing equipments	-	10	05	15
CO-5	Introduction to materials & treatments	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Farm Machinery & Equipment- 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to farm machinery lab
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a)Books:

S.No.	Title	Author	Publisher	Edition &Year
1	Principles of Agricultural Engineering. Vol. I	Michael, A.M. and T.P. Ojha. Jain Brothers	Jain brothers, jodhpur	1966
2	Farm Tractors, Maintenance and Repair	Rai and Jain	Tata Mc Graw Hill Publ. New Delhi.	1989
3	Elements of Farm Machinery	*Akhilesh Chandra Srivastava*	Oxford & IBH Publishing	1991
4	Elements of Agricultural Engineering, Vol. I & III	Singhal, O.P. Suraj Prakashan	Saroj *Prakashan*	1997

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering

Course Code: 22AE502
Course Title: Farm Machinery & Equipment I

Course Outcomes	Program Outcomes												Program SpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Understand the classification criteria for various farm machines and evolution of farm mechanization.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO2: Understand hitching systems and control mechanisms of farm machinery.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3: Students understands about tillage equipments and its uses, students calculate required draft power.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Assess field efficiency through the calculation of field capacities.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Students gain the knowledge to select and optimize materials and heat treatment processes for designing and building durable and functional agricultural machinery.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend: 1–Low,2–Medium,3– High

Course Curriculum Map:

Pos & PSOs No.	Cos No.&Titles	SOs No.	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning(SL)
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO1,2,3,4**	CO-1: Understand the classification criteria for various farm machines and evolution of farm mechanization.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6	**As Mentioned along with the concern units**	Unit-1. Introduction to farm mechanization 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO1,2,3,4**	CO 2: Understand hitching systems and control mechanisms of farm machinery.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Economic Analysis of farm machineries-2.1,2.2,2.3,2.4	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO1,2,3,4**	CO3: Students understands about tillage equipment's and its uses, students calculate required draft power.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		Unit-3 Introduction to tillage equipments 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO1,2,3,4**	CO4: Assess field efficiency through the calculation of field capacities.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Introduction to sowing equipments -4.1, 4.2,4.3,4.4,4.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 **PSO1,2,3,4**	CO5: Students gain the knowledge to select and optimize materials and heat treatment processes for designing and building durable and functional agricultural machinery.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5: Introduction to materials & treatments 5.1,5.2,5.3,5.4,5.5	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-V

Course Code: 22AE523

Course Title: **Agricultural Structures and Environmental Control**

Pre-requisite: Students have the basic knowledge of Basic understanding of physical, biology and chemistry properties/concepts, processing of harvested field crop and animal husbandry.

Rationale: Agricultural Structures and Environmental Control (AS&EC) are multifaceted, encompassing design, optimization, and creating a productive agricultural environment. It also deals with the design structures that are efficient in terms of resource utilization as well as equip the learners with the ability to plan and design farm layouts, considering factors like functionality, workflow, and waste management.

Course Outcomes:

AE 503.1: Understand and assess the environmental requirements of different agricultural operations, including crops, livestock, and storage needs.

AE 503.2: Acquired the knowledge of the design basic agricultural structures considering factors like functionality, building materials, structural integrity, and cost-effectiveness.

AE 503.3: Develop the ability to critically assess and integrate sustainable design principles into agricultural structures.

AE 503.4: Applying engineering principles to solve problems related to technical drawings, plans, and specifications for the construction of agricultural structures according to relevant building codes and safety standards.

AE 503.5: Learn basic cost estimation techniques for agricultural structures, considering materials, labor, and equipment requirements.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(PCC)	**22AE523**	**Agricultural Structures and Environmental Control**	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:
Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	**22AE523**	**Agricultural Structures and Environmental Control (Theory)**	0	15	15	0	0	30	50	80
		Agricultural Structures Environmental Control (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 503.1: Planning and layout of farm stead
Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	4	6	2	2	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the factors affecting farmstead layout. SO1.2 Design a functional farmstead layout. SO1.3 Efficient use of labor and resources translates to lower operational costs. SO1.4 Estimate the space needed for different agricultural operations based on factors like herd size, storage needs, and machinery requirements. SO1.5 Understand the essential standards parameters regarding livestock production.	• Environmental indices for your city. • Harmonic analysis for sole-air temperature. • Find-out the reflective and no reflective air space in buildings.	Unit-1.0 Planning and layout of farm stead. Physiological reactions of livestock to solar radiation and other environmental factors, livestock production facilities, BIS Standards for dairy, piggery, poultry and other farm structures.	1. Strategic placement of buildings and equipment allows for a more logical flow of farm activities. 2. Efficient farm operations free up time for farmers and their families, leading to a better work-life balance.

SW-1 Suggested Sessional Work (SW):

Assignments:

(i) Design and planning and layout of farm stead.

(i) Draw flowchart for Farm operations.

Mini Project:

Determination various stages of associate agricultural operations.

AE 503.2: Farm Structures
Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	8	8	2	2	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Understanding of different types of farm structures and their uses. **SO2.2** Knowledge of factors to consider when designing and selecting farm structures. **SO2.3 Awareness** of traditional and improved farm structures and recent developments. **SO2.4** Development of basic knowledge of designing farm structures. **SO2.5** Ability to identify the appropriate farm structure for a specific need.	• Design and layout of a dairy farm. • Design and layout of a poultry house. • Design and layout of a sheep/goat house. • Design of a biogas plant.	**Unit-2.0 Farm Structures** Design, construction cost estimation of farm structures; Animal shelters, Compost pit, Fodder silo, Fencing Implement sheds, Barn for cows, buffalo, poultry, etc.	1. Scope and importance of drying in food processing 2. Various applications of drying in Agril. Processing

SW-2 Suggested Sessional Work (SW):

Assignments:

(i) Discuss and identify the appropriate cast of various farm structures.
(ii) Draw floor plans for different animal shelters.

Mini Project:

Design and select appropriate farm structures as per the AKSU needs.

AE 503.3: Rural Engineering - I

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	4	6	1	2	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Understand core engineering principles to solve problems specific to rural areas. **SO3.2** Analyze and assess the needs of rural communities. **SO3.3** Design and develop appropriate technological solutions that are feasible and beneficial for rural settings. **SO3.4** Understand the social and environmental impact of engineering projects in rural areas. **SO3.**5 Effectively communicate technical concepts to rural communities and stakeholders.	1.Design of a feed/fodder storage structures. 2. Familiarization with local grain storage structures. 3.Design of grain storage structures.	**Unit-3.0 Rural Engineering - I** Design and construction of rural grain storage system; Engineering for rural living and development, Rural roads, their construction cost repair and maintenance.	1.Scope and importance of Traditional storage systems 2.Various applications of engineering principals in rural livelihood.

SW-3 Suggested Sessional Work (SW):

Assignments:

Discuss the primary processing in different groups of agricultural produce.

Mini Project:

Write a report on the challenges and opportunities on house suitable for a rural area.

AE 503.4: Rural Engineering - II

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	11	4	2	2	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Understand core engineering principles to solve problems specific to rural areas. **SO3.2** Analyze and assess the needs of rural communities. **SO3.3** Design and develop appropriate technological solutions that are feasible and beneficial for rural settings. **SO3.4** Understand the social and environmental impact of engineering projects in rural areas. **SO3.5** Effectively communicates technical concepts to rural communities and stakeholders.	1.Study of energy estimation of a farm building. 2.Estimation of total water requirements for farm.	**Unit-4.0 Rural Engineering - II** .Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community. .Site and orientation of building in regard to sanitation, .community sanitation system; .sewage system its design, cost and maintenance, design of septic tank for small family. Estimation of power requirement for domestic and irrigation, source of power supply, Use of alternate source of energy, Electrification of rural housing.	1.Scope and importance of drinking water standards. 2. Various applications alternate source of energy in agricultural operations.

SW-4 Suggested Sessional Work (SW):

Assignments:

Discuss on the feasibility of using renewable energy sources (solar, wind, biomass) to power a rural village.

Design a sustainable irrigation system for a small farm. Consider factors like water availability, crop water needs, and energy efficiency.

Mini Project:

Write a report on the role of rural infrastructure development in poverty alleviation.

AE 503.5: Environmental Control and Eco-System

Approximate Hours

Item	CI	LI	SW	SL	Total
Appx. Hrs	7	6	2	2	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand the structure and function of different ecosystems. **SO5.2** Analyze the relationships between organisms and their environment. **SO5.3** Apply scientific principles to understand and solve environmental problems. **SO5.4** Evaluate the effectiveness of different environmental control technologies. **SO5.5** Evaluate the impact of human activities on ecosystems.	1. Study of different instruments for measurements of environmental parameters. 2.Study of different renewable and non-renewable resources and their evaluation; 3. Study of primary and secondary treatment of waste.	**Unit-5.0 Environmental Control and Eco-System** Scope, importance and need for environmental control, renewable and non-renewable resources and their equitable use, Concept of eco system, biodiversity of its conservation, Environmental pollution and their control, solid waste management system, BOD and COD of food plant waste, Primary and secondary treatment of food plant waste.	1. Scope and importance of milling process food processing 2. Various applications of oil milling in Agril. Processing

SW-5 Suggested Sessional Work (SW):

Assignments:

Discuss the primary processing in different groups of agricultural produce.
Draw flowchart for various milling process

Mini Project:

Various products and by-products recovered from milling operation.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl + SW + Sl)
AE 503.1 Planning and layout of farm stead	4	6	2	2	14
AE 503.2 Farm Structures	8	8	2	2	20
AE 503.3 Rural Engineering - I	4	6	1	2	13
AE 503.4 Rural Engineering - II	11	4	2	2	19
AE 503.5 Environmental Control and Eco-System	7	6	2	2	17
Total Hours	**34**	**30**	**9**	**10**	**83**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
AE 503.1	Planning and layout of farm stead	04	04	02	10
AE 503.2	Farm Structures	04	04	02	10
AE 503.3	Rural Engineering - I	04	04	02	10
AE 503.4	Rural Engineering - II	04	04	02	10
AE 503.5	Environmental Control and Eco-System	04	04	02	10
Total		**20**	**20**	**10**	**50**

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

The end of semester assessment for Agricultural Structures and Environmental Control 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to seed processing plants
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/s	Publisher	Edition &Year
1	Principles and practices of Agricultural Structures and Environmental Control,	Pandey, P.H..	Kalyani Publishers, Ludhiana	Revised edition 2019
2	Principles of Agricultural Engineering, Vol. I,	T.P Ojha and A.M. Michael	Jain Brothers, Karol Bag, New Delhi.	2000
3	Agricultural Structures and Environmental Control by Manish Dubey (2017)			
4	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
5	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering
Course Code: 22AE523
Course Title: Agricultural Structures and Environmental Control

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Apply knowledge of engineering principles to the design, construction, operation, and maintenance of agricultural structures and environmental control systems.	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO-2 Analyze and solve problems related to the interaction of agricultural structures, the environment, plants, animals, and humans.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO-3 Manage agricultural structures and environmental control systems for safety, efficiency, and sustainability.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Select and use appropriate materials and technologies for the construction and operation of agricultural structures and environmental control systems.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 Communicate effectively with stakeholders on issues related to agricultural structures and environmental control and apply professional ethics and standards to the practice of agricultural engineering.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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 Planning and layout of farm stead.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	AE 503.1Planning and layout of farm stead 1.1,1.2,1.3,1.4	As Mentioned along with the concern units
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	CO-2 Farm Structures	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 503.2 Farm Structures 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	CO-3 Rural Engineering - I	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 503.3 Rural Engineering – I 1.1,1.2,1.3,1.4	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	CO-4 Rural Engineering - II	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 503.4 Rural Engineering – II 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	CO-5 Environmental Control and Eco-System	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 503.5 Environmental Control and Eco-System 1.1,1.2,1.3,1.4,1.5,1.6,1.7,	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-V

Course Code: 22HO524

Course Title: **Post-Harvest Engineering of Cereals, Pulses and Oil Seeds**

Pre-requisite: Student should have basic knowledge of physical properties and processing practices of harvested field crop.

Rationale: The course deals with the processes and technologies involved after harvesting of the crops like cleaning and grading; size reduction and machinery; drying systems, dryers, mixing of food products, milling of various crops. It also includes the working principles and designs of various machinery and tools used to deal with harvested crops.

Course Outcomes:

AE 504.1: Understand the conceptual knowledge about importance and scope of food processing, post-harvest losses, principles and methods of food processing.

AE 504.2: Acquired the knowledge of types of raw materials used in Food Processing, along with its physical and chemical characteristics.

AE 504.3: Understanding the unit operations involved in processing cereals, pulses, and oilseeds. This includes cleaning, grading, drying, storage, milling, and packaging.

AE 504.4: Applying engineering principles to solve problems related to post-harvest handling and processing. This could involve designing or selecting appropriate equipment, optimizing processes for efficiency, or minimizing losses during storage.

AE 504.5: Learning about the working principles and selection of machinery used for processing these crops. Students will gain an understanding of different types of dryers, cleaners, mills, and other equipment.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
(PCC)	22HO524	Post-Harvest Engineering of Cereals, Pulses and Oil Seeds	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:

Theory

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+ SA+CAT +AT)		
PCC	22HO524	**Post-Harvest Engineering of Cereals, Pulses and Oil Seeds (Theory)**	0	15	15	0	0	30	50	80
		Post-Harvest Engineering of Cereals, Pulses and Oil Seeds (Practical/Lab)	15	0	0	5		20	0	20
		Total								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.

AE 504.1: Cleaning and grading of crop produces and size reduction process

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	6	2	2	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand minimal processing of farm produces. **SO1.2** Importance of agricultural processing. **SO1.3** Development in cleaning and grading of crop produces. **SO1.4** Types of cleaner and grader in India and its use. **SO1.5** Design and performance evolution of cleaning and grading operations.	Performance evaluation of different types of cleaners and separators; Determination of separation efficiency; Study of different size reduction machines and performance evaluation;	**Unit-1.0** **Cleaning and grading**, aspiration, scalping; size separators Screens/sieve analysis, capacity and effectiveness of screens. Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, color sorters. **Size reduction:** principle, Bond's law, Kick's law, Rittinger's law Size reduction: Procedure (crushing, impact, cutting and shearing), Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill.	Scope and importance of food processing Various applications of Size reduction in Agril. Processing

Assignments:

- Discuss the primary PH losses in different groups of agricultural produce.
- Draw flowchart for PHT process

Mini Project:

- Determination various stages of post-harvest loss agricultural produce.

AE 504.2: Grain drying process

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	6	2	2	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understand importance drying process of farm produces. **SO2.2** Importance of agricultural processing. **SO2.3** Development in Drying of crop produces. **SO2.4** Types of dryers in India and its use. **SO2.5** Design and performance evolution of cleaning and grading operations.	Performance evaluation of different types of cleaners and separators; Determination of separation efficiency; Study of differe size reduction machines and performance evaluation;	**Unit-2.0** **Drying:** moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect**.** **EMC determination- Psychrometric** chart and its use in drying, drying principles and theory, thin layer and deep bed drying analysis, falling rate and constant rate drying periods, maximum and decreasing. Drying rate period, drying equations, Mass and energy balance, Shedd's equation. **Dryer performance**, Different methods of drying, batch-continuous; mixing-non-mixing, Sun-mechanical, conduction, convection, radiation, superheated steam, tempering during drying, **Different types of grain dryers:** bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray.	Scope and importance of drying in food processing. Various applications of drying in Agril. Processing

Assignments:

- Discuss the primary PH losses in different groups of agricultural produce.
- Draw flowchart for drying process

Mini Project:

- Various application of drying in agricultural produce.

AE 504.3: Rice and Pulses Milling process

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	5	6	2	2	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Understand importance milling process of grains. **SO3.2** Importance of agricultural processing. **SO3.3** Development in milling of crop produces. **SO3.4** Types of Milling practices in India and its use. **SO3.5** Design and performance evolution of grain milling operations.	• Performance evaluation of different types of Rice and Dal mills; • Determination of milling efficiency; • Study of different grain milling machines and performance evaluation;	**Unit-3.0** **Milling of rice:** Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, Different unit operations and equipment **Milling of wheat,** unit operations and equipment. **Milling of pulses:** traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods, Pulse Milling-Pulse milling machines.	Scope and importance of milling process food processing Various applications of grain milling in Agril. Processing

Assignments:

- Discuss the primary processing in different groups of agricultural produce.
- Draw flowchart for various milling process

Mini Project:

- Various products and by-products recovered from milling operation.

AE 504.4: Milling of Corn and Oilseed Processing

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	2	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Understand importance milling process of grains. **SO4.2** Importance of oilseeds in agricultural processing. **SO4.3** Development in oil milling. **SO4.4** Types of Milling practices in India and its use. **SO4.5** Design and performance evolution of milling operations.	• Study of different equipment's in oil mills and their performance evaluation; • Determination of oil milling efficiency; • Study of different oil milling machines and performance evaluation;	**Unit-4.0** Milling of corn and its products. Dry and wet milling **Milling of oilseeds:** mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, **Refining of oil**, stabilization of rice bran Different unit operations and equipment **Milling of wheat,** unit operations and equipment. **Milling of pulses:** traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods, Pulse Milling- Pulse milling machines.	Scope and importance of milling process food processing. Various applications of oil milling in Agril. Processing

Assignments:

- Discuss the primary processing in different groups of agricultural produce.
- Draw flowchart for various milling process

Mini Project:

- Various products and by-products recovered from milling operation.

AE 504.5: Material Handling practices and advancements in Agricultural Processing

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	5	6	2	2	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Understand importance material handling in grains processing. **SO5.2** Importance of material handling devices in agricultural processing. **SO5.3** Development in Agril. Processing **SO5.4** Types of by-products and their utilizations. **SO5.5** Food extrusion technology	• Study of different types of material handling equipment's and their performance evaluation; • Design development of material handling; Study of different products and by-products and their utilizations	**Unit-5.0** **Milling of rice:** Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, Different unit operations and equipment **Milling of wheat,** unit operations and equipment. **Milling of pulses:** traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods, Pulse Milling- Pulse milling machines.	• Scope and importance of milling process food processing • Various applications of oil milling in Agril. Processing

Assignments:

- Discuss the primary processing in different groups of agricultural produce.
- Draw flowchart for various milling process

Mini Project:

- Various products and by-products recovered from milling operation.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL + LI+SW + SL)
AE 504.1: Cleaning and grading of crop produces and size reduction process	5	6	2	2	15
AE 504.2: Grain Drying process	5	6	2	2	15
AE 504.3: Rice and Pulses Milling process	5	6	2	2	15
AE 504.4: Milling of Corn and Oilseed Processing	6	6	2	2	16
AE 504.5: Material Handling practices in Agricultural Processing	5	6	2	2	15
Total Hours	**26**	**30**	**10**	**10**	**76**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Understand the conceptual knowledge about importance and scope of food processing, post-harvest losses, principles and methods of food processing.	04	05	01	10
CO-2	Acquired the knowledge of types of raw materials used in Food Processing, along with its physical and chemical characteristics.	04	04	02	10
CO-3	Understanding the unit operations involved in processing cereals, pulses, and oilseeds. This includes cleaning, grading, drying, storage, milling, and packaging.	05	04	03	11
CO-4	Applying engineering principles to solve problems related to post-harvest handling and processing. This could involve designing or selecting appropriate equipment, optimizing processes for efficiency, or minimizing losses during storage.	04	05	03	12
CO-5	Learning about the working principles and selection of machinery used for processing these crops. Students will gain an understanding of different types of dryers, cleaners, mills, and other equipment.	03	02	02	07
Total		**20**	**20**	**10**	**50**

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

The end of semester assessment for Post Harvest Engineering of Cereals, Pulses and Oil Seeds 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to seed processing plants
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/s	Publisher	Edition &Year
1	Post-Harvest Technology of cereals, pulses and oilseeds	Chakraverty, A.	Oxford & IBH publishing Co. Ltd., New Delhi	Revised edition 2022
2	Unit operations of Agricultural Processing	Sahay, K.M. and Singh, K.K.	Vikas Publishing house Pvt. Ltd. New Delhi	1994
3	Agricultural Process Engineering	Henderson, S.M., and Perry, R. L.	Chapman and hall, London	2006
4	Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi			
5	McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.			
6	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
7	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

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<u>**Cos, Pos and PSOs Mapping**</u>

Course Title: B. Tech. Agricultural Engineering
Course Code : 22HO501
Course Title: Post Harvest Engineering of Cereals, Pulses and Oil Seeds

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO 1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Understand the conceptual knowledge about importance and scope of food processing, post-harvest losses, principles and methods of food processing.	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**2**	**2**	**3**	**3**	**3**
CO-2 Acquired the knowledge of types of raw materials used in Food Processing, along with its physical and chemical characteristics.	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**
CO-3 Understanding the unit operations involved in processing cereals, pulses, and oilseeds. This includes cleaning, grading, drying, storage, milling, and packaging.	**2**	**2**	**1**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**2**	**2**	**1**
CO-4 Applying engineering principles to solve problems related to post-harvest handling and processing. This could involve designing or selecting appropriate equipment, optimizing processes for efficiency, or minimizing losses during storage.	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**	**3**	**3**	**2**
CO-5 Learning about the working principles and selection of machinery used for processing these crops. Students will gain an understanding of different types of dryers, cleaners, mills, and other equipment.	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**3**	**1**	**1**	**2**	**2**	**3**	**3**	**1**	**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**	**CO-1** Understand the conceptual knowledge about importance and scope of food processing, post-harvest losses, principles and methods of food processing.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	AE 501.1: Cleaning and grading of crop produces and size reduction process	As Mentioned along with the concern units
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-2** Acquired the knowledge of types of raw materials used in Food Processing, along with its physical and chemical characteristics.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 501.2: Grain Drying process	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-3** Understanding the unit operations involved in processing cereals, pulses, and oilseeds. This includes cleaning, grading, drying, storage, milling, and packaging.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 501.3: Rice and Pulses Milling process	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-4** Applying engineering principles to solve problems related to post-harvest handling and processing. This could involve designing or selecting appropriate equipment, optimizing processes for efficiency, or minimizing losses during storage.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 501.4: Milling of Corn and Oilseed Processing	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-5** Learning about the working principles and selection of machinery used for processing these crops. Students will gain an understanding of different types of dryers, cleaners, mills, and other equipment.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 501.5: Material Handling practices in Agricultural Processing	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-V

CourseCode:	**22AE525**
CourseTitle:	**Soil & Water Conservation Engineering**
Pre-requisite:	To successfully understand and design effective solutions for soil and water conservation.
Rationale:	Thestudentsstudyingcomprehensive understanding erosion of soil and its control. The course covers the fundamental concepts of soil erosion, including its causes, types, and effects. It also delves into the mechanics of water and wind erosion and explores various strategies for controlling these processes. Additionally, the course emphasizes the importance of land capability classification and sedimentation monitoring in managing soil erosion.

CourseOutcomes:

AE 505.1: Understanding Soil Erosion

AE 505.2: Quantifying and Predicting Soil Loss.

AE 505.3: Controlling Water Erosion.

AE 505.4: Reclaiming Gullies and Ravines.

AE 505.5: Mitigating Wind Erosion.

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 (PCC)	**22AE525**	**Soil and Water Conservation Engg.**	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	**22AE522**	**Soil and Water Conservation Engg. (Theory)**	0	15	15	0	0	30	50	80
		Soil and Water Conservation Engg. (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE505.1: Understanding Soil Erosion
Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	6	8	2	2	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Define soil erosion and describe its different types (geological and accelerated). **SO1.2**Identify the agents and factors affecting soil erosion **SO1.3**Explain the mechanics and forms of water erosion (splash, sheet, rill, gully, ravine, and stream bank erosion), **SO1.4**Classify gullies and describe their stages of development.	**1.** Study of different types and forms of water erosion. **2.** Exercises on computation of rainfall erosivity index. **3.** Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE. **4.** Computation of soil erodibility index in soil loss estimation.	**Unit-1.0 Soil Erosion - Introduction, Causes and Types** **1.1** Soil erosion – Introduction and causes **1.2** Geological and accelerated erosion, agents, factors affecting and effects of erosion. **1.3** Water erosion – Mechanics **1.4** Water erosion forms - splash, sheet, rill, gully, ravine and stream bank erosion **1.5** Gullies - Classification, **1.6** Gullies stages of development	Read research articles and case studies on soil erosion and conservation. Watch documentaries and educational videos on the topic.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write a detailed report on the different types of soil erosion, their causes, and their effects on the environment.

ii. Create a presentation on the geological and accelerated erosion processes.

b. MiniProject:

i. Conduct a field survey to assess the extent of soil erosion in a local area.

c. OtherActivities(Specify):

i. Compare and contrast the effectiveness of different soil conservation practices in a controlled environment

AE505.2: Quantifying and Predicting Soil Loss

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	7	6	2	2	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Apply the Universal Soil Loss Equation (USLE) and Modified USLE to estimate soil loss **SO2.2**Calculate rainfall erosivity using KE>25 and EI30 methods. **SO2.3**Analyze the impact of topography, crop management, and conservation practices on soil erodibility **SO2.4** Design and implement methods for measuring soil erosion (runoff plots and soil samplers)	**1.** Study of rainfall simulator for erosion assessment. **2.** Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor. **3.** Determination of sediment concentration through oven dry method	**Unit-2Soil Loss Estimation and Measurement** **2.1** Soil loss estimation **2.2** Universal loss equation (USLE). **2.3** Modified universal soil loss equation **2.4** Erosivity estimation by KE>25 and EI30 methods **2.5** Soil erodibility **2.6** Topography, crop management and conservation practice factors **2.7** Runoff plots, soil samplers	**1.** Learn about different rainfall erosivity estimation methods **2.** Understand the concept of soil erodibility and its influencing factors

SW-2 SuggestedSessional Work(SW):

a. Assignments:

i. Calculate the soil loss using the Universal Soil Loss Equation (USLE) for a specific scenario.

ii. Compare and contrast the Modified USLE with the original USLE.

b. MiniProject:

i. Design and build a runoff plot to measure soil erosion in the field

c. OtherActivities(Specify):

i. Analyze soil samples to determine the rate of erosion in different areas

AE505.3: Controlling Water Erosion.

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	5	8	2	2	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Propose and apply agronomical measures for water erosion control (contour farming, strip cropping, conservation tillage, and mulching) **SO3.2**Design and construct bunds and terraces for water erosion control **SO3.3**Calculate the dimensions and surplus sing arrangements for contour and graded bunds **SO3.4**Plan, design, and layout procedures for level and graded broad base terraces, bench terraces, contour stonewalls, and trenching.	**1.** Design and layout of contour bunds. **2.** Design and layout of graded bunds. **3.** Design and layout of broad base terraces. **4.** Design and layout of bench terraces.	**Unit-3:Water Erosion Control Measures** **3.1** Agronomical measures - contour farming, strip cropping, conservation tillage and mulching **3.2** Engineering measures– Bunds and terraces **3.3** Bunds - contour and graded bunds - design and surplus sing arrangements **3.4** Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure **3.5** Contour stonewall and trenching	**1.** Research different types of bunds and terraces and their design principles. **2.** Learn about the benefits & limitations of different mulching materials.

SW-3SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Design a contour farming system for a specific field.
   ii. Develop a plan for implementing conservation tillage practices in a farm.
b. **MiniProject:**
   i. Construct a model of a bund or terrace to demonstrate its function.

c. **OtherActivities(Specify):**
   i. Evaluate the effectiveness of existing water erosion control measures in a local area.

AE 505.4:Reclaiming Gullies and Ravines.
Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	4	4	2	2	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Explain the principles of gully control using vegetative measures, temporary structures, and diversion drains. **SO4.2**Design and implement grassed waterways for controlling gully erosion	**1.** Design of vegetative waterways. **2.** Exercises on rate of sedimentation and storage loss in tanks	**Unit-4: Gully and Ravine Reclamation** **4.1**Principles of gully control **4.2**Vegetative Measures. **4.3**Temporary Structure and Diversion drains. **4.4**Grassed waterways and design.	**1.** Learn about the importance of grassed waterways in controlling erosion. **2.** Explore advanced technologies for gully and ravine reclamation.

SW-4SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Develop a plan for reclaiming a gully using vegetative measures.
   ii. Design a diversion drain system to control gully erosion.
b. **MiniProject:**
   i. Design and implement a small-scale gully reclamation project.

c. **OtherActivities(Specify):**
   i. Model the effectiveness of different gully control measures using software

AG505.5: Mitigating Wind Erosion.

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	8	4	2	2	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Identify the factors affecting wind erosion and its mechanics. **SO5.2**Estimate wind erosion using established methods **SO5.3**Propose and implement vegetative and mechanical measures for wind erosion control **SO5.4**Design and plant windbreaks and shelter belts for wind erosion control. **SO5.5**Explain the techniques for stabilizing sand dunes	**1.** Computation of soil loss by wind erosion. **2.** Design of shelterbelts and wind breaks for wind erosion control.	**Unit5:Wind Erosion and Land Capability Classification** **5.1**Wind erosion-Factors affecting and mechanics. **5.2**soil loss estimation **5.3**Wind Break **5.4**Shelter belts **5.5**Stabilization of sand dunes **5.6**Land capability classification. **5.7**Rate of sedimentation **5.8**Silt monitoring and storage loss in tanks	**1.** Learn about the different types of wind erosion control measures **2.** Research the principles of wind erosion and its mechanics.

SuggestedSessionalWork(SW):

a. Assignments:

i. Analyze the factors affecting wind erosion in a specific region.

ii. Calculate the potential soil loss due to wind erosion using a suitable model.

b. MiniProject:

i. Design and implement a wind break or shelter belt to protect agricultural land.

c. OtherActivities(Specify):

i. Conduct a field study to assess the effectiveness of different wind erosion control practices

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+SW+SL)
AE505.1: Understanding Soil Erosion	6	8	2	2	18
AE505.2: Quantifying and Predicting Soil Loss.	7	6	2	2	17
AE505.3: Controlling Water Erosion.	5	8	2	2	17
AE505.4: Reclaiming Gullies and Ravines.	4	4	2	2	12
AE505.5:Mitigating Wind Erosion.	8	4	2	2	16
Total Hours	30	30	10	10	80

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO-1	Soil Erosion - Introduction, Causes and Types	03	01	01	05
CO-2	Soil Loss Estimation and Measurement	02	06	02	10
CO-3	Water Erosion Control Measures	03	07	05	15
CO-4	Gully and Ravine Reclamation	-	10	05	15
CO-5	Wind Erosion and Land Capability Classification	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Soil & Water Conservation Engg. 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Krishi Vigyan Kendra
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	Soil and Water Conservation Engineering	R. Suresh	Standard Publisher Distributors	2014
2	Principles of Agricultural Engineering. Volume II. 4th Edition	A.M. Michael, and T.P. Ojha	Jain Brothers	2003
3	Manual of Soil and Water Conservation Practices	Gurmel Singh, C. Venkatara and, G. Sastry and B.P. Joshi	Oxford and IBH Publishing Co. Pvt. Ltd	1996
4	Soil and Water Conservation and Watershed Management	S.C. Mahnot	International Books and Periodicals Supply Service	2014
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

CurriculumDevelopmentTeam

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering
Course Code: 22AE525
Course Title: Soil and Water Conservation Engineering

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO505.1: Understanding Soil Erosion	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	2
CO 505 2: Quantifying and Predicting Soil Loss.	1	3	2	2	1	2	3	2	1	1	2	2	3	2	3	1
CO 505.3:Controlling Water Erosion.	2	2	3	1	2	2	2	2	1	2	2	2	1	2	2	2
CO 505 4: Reclaiming Gullies and Ravines.	3	3	2	2	3	2	3	3	2	1	2	3	3	3	3	2
CO 5055:Mitigating Wind Erosion.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend:1–Low,2–Medium,3–High

CourseCurriculumMap:

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	CO-1:Understanding Soil Erosion	SO1.1 SO1.2 SO1.3 SO1.4	As Mentioned along with the concern units	Unit-1.0 Soil Erosion - Introduction, Causes and Types 1.1,1.2,1.3,1.4,1.5,1.6	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PS O1,2,3,4	CO 2 : Understanding Soil Erosion	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2 Soil Loss Estimation and Measurement 2.1,2.2,2.3,2.4,2.5,2.6,2.7	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4	CO3 : Controlling Water Erosion	SO3.1SO3 .2 SO3.3 SO3.4		Unit-3 Water Erosion Control Measures 3.1,3.2,3.3,3.4,3.5	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4	CO 4: Reclaiming Gullies and Ravines.	SO4.1 SO4.2		Unit-4 Gully and Ravine Reclamation 4.1,4.2,4.3,4.4	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2,3,4	CO 5: Mitigating Wind Erosion.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5 Wind Erosion and Land Capability Classification 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme
Semester-V

CourseCode: 22AE526

CourseTitle: **Watershed Planning and Management**

Pre-requisite: Student should have basic knowledge of maps, filed measurement and its reequipment.

Rationale: The students studying Agricultural Engineering should possess foundational understanding about historical brief knowledge of surveying and levelling. This encompasses familiarity with theinventionand evolution of surveying and leveling and its numerical for field work observation. Additionally, students think too acquire fundamental insights into various surveying and leveling.

CourseOutcomes:

AE 506.1: A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource management and environmental conservation.

AE 506.2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.

AE 506.3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.

AE 506.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed management strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.

AE 506.5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed management programs, incorporating principles of sustainability, community participation, and effective project management.

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 (CI+LI+SW+SL)	
PCC	22CE125	Watershed Planning and Management	3	0	1	1	5	3

Legend: **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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	**22CE125**	**Watershed Planning and Management (Theory)**	0	15	15	0	0	30	50	80
		Watershed Planning and Management (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 506.1:A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource management and environmental conservation.

ApproximateHours

Item	AppXHrs
Cl	03
LI	4
SW	2
SL	2
Total	11

SessionOutcomes (SOs)	**LaboratoryInstruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 This knowledge lays the groundwork for more advanced studies and practical applications in watershed management **SO1.2**knowledge to conduct effective watershed investigations and topographical surveys, laying the foundation for watershed management practices. **SO1.3** Knowledge needed to assess, analyze, and implement effective watershed management strategies based on the understanding of soil characteristics and vegetative cover. **SO1.4**The session, participants should be equipped with the knowledge and skills needed to assess, analyze, and promote sustainable land use practices within a watershed, contributing to the overall health and resilience of the ecosystem. **SO1.5** The session, participants should be equipped with the knowledge and skills necessary to navigate the socio-economic watershed..	1- Exercises on delineation of watersheds using toposheets. 2- Surveying and preparation of watershed map.	Watershed - introduction and characteristics 1 introduction and characteristics. 1.2 Watershed development - problems and prospects investigation, topographical survey. 1.3 soil characteristics, vegetative cover. present land use practices, socio-economic factors.	**1.** the knowledge gained in practical contexts to enhance your understanding of watershed management 2. the knowledge gained in a self-designed project or case study focused on the watershed in your local area.

SW-1SuggestedSessionalWork(SW):

a. Assignments:

i. Define the understanding of watershed concepts and characteristics

ii. Write the Research and familiarize yourself with various data collection techniques used in watershed investigation,

b. MiniProject-

Explore online courses on watershed management, hydrology, and related topics offered by educational platforms.

AE506.2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.

Approximate Hours

Item	AppX Hrs
Cl	3
LI	6
SW	2
SL	2
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 To Understand a holistic understanding of the challenges and opportunities **SO2.2**Tothe knowledge, skills, and tools necessary to actively contribute to the sustainable management **SO2.3**Tounderstandthe participants will be better equipped to make informed decisions regarding land use and management. **SO2.4**Toparticipants will be better prepared to incorporate hydrologic considerations into comprehensive watershed planning efforts	1- Quantitative analysis of watershed characteristics and parameters. 2- Watershed investigations for planning and development. 3- Prioritization of watersheds based on sediment yield index.	**2.1** Watershed management concept watershed planning based on **2.2** land capability classes, hydrologic data for watershed planning **2.3** watershed codification**, delineation** and prioritization of watersheds – sediment yield index.	i. explanation of brief concept of watershed management. ii. Formation of hydrologic data for watershed study.

SW-2 SuggestedSessional Work(SW):

a. Assignments:

i. Draw the watershed stream figure with codification.
ii. Prepare a list of watershed area correction numerical problem and its concept.

AE 506.3: The theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.

ApproximateHours

Item	AppXHrs
Cl	3
LI	06
SW	2
SL	2
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 To understand the basic concept of water budgeting. **SO3.2**types of structures or accessories used for rain water harvesting. **SO3.3**knowing the different types of methods of rain water harvesting. **SO3.4**Properties and use recycling. **SO3.5** Properties and Dry farming techniques.	1.Water budgeting of watersheds. 2. Study of functional requirement of watershed development structures. 3.Study of functional requirement of watershed development structures.	**Unit-3:**Water budgeting 3.1 Management measures - rainwater conservation technologies, in-situ and ex-situ storage. 3.2 Water harvesting and recycling 3.3 Dry farming techniques - inter-terrace and inter-bund	i. learn basic specification of water budgeting. ii. Advantages ofrain water harvesting

SW-3SuggestedSessionalWork(SW):

a. Assignments:

i. What is Dry farming? Explain the different types Dry farming techniques with suitable figure.
ii. Explain the various rainwater conservation technologies in detail.

b. MiniProject:

To identify the water harvesting structures used for urban and rural area.

AE 506.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed management strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.

Approximate Hours

Item	AppXHrs
Cl	3
LI	04
SW	2
SL	2
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 To understand the basic concept of Integrated watershed management **SO4.2**Understandingthebasic components and various method of watershed management **SO4.3** Understanding the difficulties occurs in arable- non-arable lands. **SO4.4**understand the error in cropping systems. **SO4.5**To understand the basic concept of contour and knowing th concept of watershed hydrology.	1- Analysis of hydrologic data for planning watershed management. -Study of watershed management technologies. •Practice on softwares for analysis of hydrologic parameters of watershed.	Unit-4: Integrated watershed management 4.1 concept, components, watershed management, arable lands agriculture and horticulture, Briefnon-arable lands, forestry, fishery and animal husbandry. Effect of cropping systems land management and cultural practices on watershed hydrology	Preparation ofprocess flowchart of Integrated watershed management operations of agriculture field. Draw a typical cropping pattern map of agriculture India.

SW-4SuggestedSessionalWork(SW):

a. Assignments:

i. Describe the Integrated watershed management in detail.

ii. Describebrieflythe different type of hydrological required for watershed management.

MiniProject:

i. To create the elevation difference counter map.

AE 506.5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed management programs, incorporating principles of sustainability, community participation, and effective project management.

Approximate Hours

Item	AppXHrs
Cl	03
LI	06
SW	2
SL	2
Total	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1overview learning of Watershed programme **O5.2**Overview understating maintenance and monitoring of Watershed programme **SO5.3**Roleofthewatershed associations and survey. **SO5.4**Overview off formulation of project proposal. **SO5.5**Basic cost-benefit analysi of Watershed programme	1. Techno-economic viability analysis of watershed projects. 2.Study of role of various functionaries in watershed development programmes. 3.Visit to watershed development project areas.	**Unit5Watershed programme** 5.1 - execution, follow-up practices .maintenance, monitoring ,Evaluation 5.2 Participatory watershed management - role of watershed associations, 5.3 user groups and self-help groups. Planning and formulation of project proposal for watershed management programme. including cost-benefit analysis.	1.To know the maintenance of vertical and horizontal angle by theodolite survey. 2.Explore the Planning project proposal for watershed management programme .

SW-5SuggestedSessionalWork(SW):

a. **Assignments:**

- Explain the cost- benefit analysis for watershed watershed management programme.
- Explain the role of people's participation in watershed management programme.

Brief of Hours suggested for the Course Outcome

CourseOutcomes	Class Lecture (Cl)	LaboratoryInstruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+LI+SL)
AE 506.1: a comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource management and environmental conservation.	3	4	2	2	11
AE 506.2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.	3	6	2	2	13
AE 506.3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand the complexities of water budgets, be familiar with a range of conservation technologies, and be capable of implementing and integrating these measures in diverse contexts.	3	6	2	2	13
AE 506.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed management strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.	3	4	2	2	11
AE 506.5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed management programs, incorporating principles of sustainability, community participation, and effective project management	3	6	2	2	13
TotalHours	15	**26**	10	10	61

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

CO	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO-1	Watershed - introduction	05	01	00	06
CO-2	Watershed management	06	02	01	9
CO-3	Water budgeting in a watershed	06	05	03	14
CO-4	Integrated watershed management	06	06	02	14
CO-5	Watershed programme	05	02	-	07
Total		28	16	06	50

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

The end of semester assessment for Watershed Planning and 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile,Online sources)
8. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Hydrology and Soil Conservation Engineering:	Ghanshyam Das. 2008	2nd Edition, Prentice-Hall of India Learning Pvt. Ltd	2nd Edition
2	Soil and Water Conservation and Watershed Management	Mahnot, S.C.	International Books and Periodicals Supply Service. New Delhi	2014
3	Norms For LimestoneExploration For CementManufacture	WatershdManagent: Design and Practices	E-media Publications, Udaipur.	2000.
4	Watershed Planning and Management	Singh, R.V	Yash Publishing House, Bikaner	2000
5	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
6	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agril. Engineering
Course Code: 22AE526

Course Title: Watershed Planning and Management

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
AE 506.1: a comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource management and environmental conservation.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
AE 506.2: Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
AE 506.3: The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
AE 506.4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed management strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
AE 506.5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed management programs, incorporating	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend:1–Low,2–Medium,3–High

Curriculum Map

Pos & PSOs No.	Cos No.& Titles	SOsNo.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-1:: A comprehensive course on watershed development should blend theoretical knowledge with practical skills, preparing students to contribute effectively to sustainable resource management and environmental conservation.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	Unit-1.0knowledge with practical skills, preparing students to contribute effectively to sustainable resource management. 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 2 : Overall, the course should equip students with the knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence their health and productivity.	SO2.1 SO2.2 SO2.3 SO2.4		Unit-2knowledge and skills necessary to assess, plan, and manage watersheds sustainably, considering the diverse factors that influence 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO3 : The end of the course, students should be well-equipped with the theoretical and practical knowledge needed to contribute effectively to sustainable water management within watersheds. They should understand the complexities of water budgets.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 : the complexities of water budgets, be familiar with a range of conservation technologies 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 4: The end of the course, students should be equipped with the knowledge and skills necessary to plan and implement integrated watershed management strategies that consider the diverse needs of the community while maintaining ecological balance and sustainability.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4:knowledge and skills necessary to plan and implement integrated watershed 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 5: Upon completing the course, students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed management programs, incorporating principles of sustainability, community participation, and effective project management	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5:The students should be well-prepared to actively contribute to the planning, execution, and evaluation of watershed 5.1,5.2,5.3,5.4,5.5	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-V

Course Code:	[22AE527]
Course Title:	**Drainage Engineering**
Pre-requisite:	Student should have basic knowledge about water logging, drainage principles
Rationale:	Students will able to understand and address water logging issues, design effective drainage systems, manage salt balance, and ensure sustainable water utilization in agriculture to improve agricultural productivity and environmental sustainability.

Course Outcomes:

AE507.1: Understand the fundamentals of drainage, identify drainage problems, and design surface drainage systems.

AE507.2: Comprehend the principles of subsurface drainage, investigate design parameters, and derive drain spacing equations.

AE507.3: Design subsurface drainage systems, select appropriate drainage materials and pipes, and implement layout, construction, and installation techniques.

AE 507.4: Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance

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 (PCC)	22AE527	Drainage Engineering	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	**22AE521**	**Drainage Engineering (Theory)**	0	15	15	0	0	30	50	80
		Drainage Engineering (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 507.1: Understand the fundamentals of drainage, identify drainage problems, and design surface drainage systems.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	6	4	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1: Explain the causes and impacts of water logging. **SO1.2** Define drainage and state its objectives **SO1.3** Identify the different types of drainage problems in the state **SO1.4** Calculate the surface drainage coefficient. **SO1.5** Differentiate between different types of surface drainage systems **SO1.6** Design surface drains	**1.** In-situ measurement of hydraulic conductivity by single auger hole and inverse auger hole method. **2.** Estimation of drainage coefficients	**Unit-1.0 Introduction to Drainage Engineering** **1.1** Water logging- causes and impacts. **1.2** Objectives of drainage **1.3** Familiarization with the drainage problems of the state; **1.4** Surface drainage coefficient **1.5** Types of surface drainage **1.6** Design of surface drains.	**1.** Analyze the drainage problems specific to your state or region. **2.** Calculate and interpret surface drainage coefficients for various land types

SW-1Suggested Sessional Work (SW):

Assignments:

i. Write a short report on the causes and impacts of water logging in your state.

ii. Design a surface drainage system for a specific agricultural field, considering factors like slope, soil type, and rainfall intensity.

Mini Project:

i. Develop a proposal for improving drainage in a waterlogged area.

Other Activities (Specify):

i. Conduct a field experiment to evaluate the effectiveness of a new drainage material or technology

AE 507.2: Comprehend the principles of subsurface drainage, investigate design parameters, and derive drain spacing equations.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	9	6	2	2	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Explain the purpose and benefits of subsurface drainage **SO2.2** Investigate and determine design parameters for subsurface drainage systems, including hydraulic conductivity, drainable porosity, and water table. **SO2.3** Derive Hooghoudt's and Ernst's drain spacing equations.	**1.** Design of surface drainage systems **2.** Design of gravel envelop **3.** Design of subsurface drainage systems	**Unit-2 Subsurface Drainage** **2.1** Sub-Surface Drainage, Water Table. **2.2** Sub-Surface Drainage Purpose and Benefits **2.3** Investigations of Design Parameters **2.4** Hydraulic Conductivity **2.5** Drainable Porosity **2.6** Design of Surface Drains. **2.7** Drainable Porosity **2.8** Derivation of Hooghoudt's **2.9** Ernst's drain spacing equations	**1.** Understand the purpose and benefits of subsurface drainage **2.** Learn how to derive Hoodhoudt's and Ernst's drain spacing equations

SW-2 Suggested Sessional Work (SW):

Assignments:

i. Research and compare different materials used for subsurface drainage pipes.

Mini Project:

i. Develop a cost-benefit analysis for implementing a subsurface drainage system in a specific area.

Other Activities (Specify):

i. Conduct a field experiment to evaluate the effectiveness of a new drainage material or technology

AE 507.3: Design subsurface drainage systems, select appropriate drainage materials and pipes, and implement layout, construction, and installation techniques.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	5	4	2	2	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1: Design subsurface drainage systems. **SO3.2**: Select appropriate drainage materials, drainage pipes, and drain envelope. **SO3.3**: Layout, construct, and install drains.	**1.** Design of gravel envelop **2.** Design of subsurface drainage systems	**Unit-3: Subsurface Drainage System Design** **3.1** Design of subsurface drainage system **3.2** Drainage materials **3.3** Drainage pipes **3.4** Drain envelope layout **3.5** Construction and installation of drains	**1.** Learn about different types of drainage materials and their properties. **2.** Understand the importance of a drain envelope and its design consideration.

SW-3 Suggested Sessional Work (SW):

Assignments:

i. Develop a layout plan for a subsurface drainage system based on site conditions and project requirements.

ii. Research and compare different construction methods for installing drainage pipes.

Mini Project:

i. Design and install a subsurface drainage system for a small-scale project, such as a garden or sports field.

Other Activities (Specify):

i. Develop a maintenance plan for an existing subsurface drainage system.

AE 507.4: Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	8	2	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Describe different types of drainage structures and their applications **SO4.2** Explain the principles of vertical drainage, bio-drainage, and mole drains **SO4.3** Calculate leaching requirements for salt balance management **SO4.4** Explain the concept of conjunctive use of fresh and saline water	**i.** Determination of chemical properties of soil and water	**Unit-4: Drainage Structures and Salt Balance Management** **4.1** Drainage structures **4.2** vertical drainage **4.3** Bio-drainage **4.4** Mole drains **4.5** Salt balance **4.6** Reclamation of saline and alkaline soils ne water **4.7** Leaching requirements **4.8** Conjunctive use of fresh and saline	**i.** Learn about the concept of salt balance and its importance in soil management **ii.** Understand the principles of vertical drainage, bio-drainage, and mole drains.

SW-4 Suggested Sessional Work (SW):

Assignments:

i. Research and compare different bio-drainage techniques and their effectiveness.

ii. Calculate the leaching requirements for maintaining salt balance in a specific soil type.

Mini Project:

i. Conduct a field study to monitor the effectiveness of a bio-drainage system.

Other Activities (Specify):

i. Research and propose a conjunctive use strategy for fresh and saline water in a specific region.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour(CL+ SW+SL)
AE507.1: Understand the fundamentals of drainage, identify drainage problems, and design surface drainage systems.	6	4	2	2	14
AE 507.2: Comprehend the principles of subsurface drainage, investigate design parameters, and derive drain spacing equations.	9	6	2	2	19
AE 507.3: Design subsurface drainage systems, select appropriate drainage materials and pipes, and implement layout, construction, and installation techniques.	5	4	2	2	13
AE 507.4: Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance	8	2	2	2	14
Total Hours	28	16	8	8	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Introduction to Drainage Engineering	03	01	01	05
CO-2	Subsurface Drainage	02	06	02	10
CO-3	Subsurface Drainage System Design	03	07	05	15
CO-4	Drainage Structures and Salt Balance Management	-	10	05	15
Total		11	26	13	50

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

The end of semester assessment for Drainage Engineering willbeheldwithwrittenexaminationof50 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Agriculture plant
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,Onlinesources)
9. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Land Drainage, Principles , Methods and Applications	AK Bhattacharya and AM Michael	Vikas Publication House	2013
2	Principles of Agricultural Engineering Vol-II 5th Edition	AM Michael. and TP Ojha	Jain Brothers Publication	2014
3	Agricultural Drainage- Principles and Practices	U.S. Kadam., R.T. Thokal	Westville Publishing House	2007
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

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<u>**Cos, Pos and PSOs Mapping**</u>

Course Title: **B.Tech. Agricultural Engineering**
Course Code: **22AE527**
Course Title: **Drainage Engineering**

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO 3**	**PSO4**
	Engineering knowledge	**Problem analysis**	**Design/development of solutions**	**Conduct investing actions 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**	**To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.**	**To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies**	**To inculcate entrepreneurial skills through strong Industry-Institution linkage**	**Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.**
CO1:Understand the fundamentals of drainage, identify drainage problems, and design surface drainage systems	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Comprehend the principles of subsurface drainage, investigate design parameters, and derive drain spacing equations	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3:Design subsurface drainage systems, select appropriate drainage materials and pipes, and implement layout, construction, and installation techniques.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO 4: Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2

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 PSO1,2,3,4,5,6	CO-1:Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6	As Mentioned along with the concern units	Unit-1.0Introduction to Drainage Engineering 1.1,1.2,1.3,1.4,1.5,1.6	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3	CO 2 : Comprehend the principles of subsurface drainage, investigate design parameters, and derive drain spacing equations	SO2.1 SO2.2 SO2.3	As Mentioned along with the concern units	Unit-2Subsurface Drainage 2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3	CO3 : Design subsurface drainage systems, select appropriate drainage materials and pipes, and implement layout, construction, and installation techniques	SO3.1 SO3.2 SO3.3	As Mentioned along with the concern units	Unit-3: Subsurface Drainage System Design 3.1,3.2,3.3,3.4,3.5	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 4: Analyze drainage structures & vertical drainage, bio and mole drains and manage salt balance.	SO4.1 SO4.2 SO4.3 SO4.4	As Mentioned along with the concern units	Unit-4: Drainage Structures and Salt Balance Management 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	As Mentioned along with the concern units

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme
Semester-V

CourseCode: 22AE528

CourseTitle: **Renewable Power Sources**

Pre-requisite: Student should have basic knowledge of renewable energy sources such as solar wind and biomass and its application or merits.

Rationale: The students studying agricultural engineering should possess foundational understanding about energy consumption patterns, energy resources, and various renewable energy technologies in India is multifaceted and critical for the country's sustainable development. Here's an overview of the key considerations for each aspect mentioned. Technologies in India are rooted in the country's pursuit of sustainable development, economic growth, and environmental stewardship.

CourseOutcomes:

AE508.1: Studentsanalyze energy scenario in India and identify conventional & non-conventional resources. Evaluate renewable energy options like solar, wind, biomass, and hydro, and discuss energy efficiency & security.

AE508.2: Students understanding Understand biogas technology, design & operate biogas plants, and calculate biogas yield. Evaluate power generation from biogas and analyze potential of utilizing waste for biogas production.

AE508.3: Design & select biogas plants, understand their operation & maintenance, and analyze performance. Design & implement solar thermal systems and understand principles & operation of solar photovoltaic systems.

AE508.4: Students Analyze design & operation of central receiver & distributed solar power plants. Understand OTEC, MHD, hydrogen fuel cell technology, and analyze their potential & challenges.

AE508.5: Students understand wind energy conversion system, biomass gasification &dendro thermal power generation and understand fuel cell technology & parameters.

Scheme of Studies:

Board of Study	Course Code	CourseTitle	Scheme of studies (Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core (PCC)	22AE528	**Renewable Power Sources**	3	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	22AE528	**Renewable Power Sources** (Theory)	0	15	15	0	0	30	50	80
		Renewable Power Sources (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE508.1: Students analyze energy scenario in India and identify conventional & non-conventional resources. Evaluate renewable energy options like solar, wind, biomass, and hydro, and discuss energy efficiency & security.

ApproximateHours

Item	AppX Hrs
Cl	4
LI	4
SW	2
SL	1
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the current energy consumption pattern in India **SO1.2**Identify and understand the different types of energy resources available in India **SO1.3**Evaluate the potential of different renewable energy options in India **SO1.4**Student **know the importance of energy efficiency and energy security in sustainable development** **SO1.5** Discuss the environmental impacts of energy production and use.	1.1 To study about Performance evaluation of solar water heater 1.2 To study about Performance evaluation of solar cooker	**Unit-1.0 Energy options, consumption and its potential** 1.1 Identify the key sectors driving energy demand in India. 1.2 Analyze the trends in energy consumption over time 1.3 Discuss the factors influencing energy consumption patterns 1.4 Study the Renewable energy options, potential and utilization	Collect data on energy consumption in different sectors (residential, commercial, industrial, agricultural) over the past 2-5 years.

SW-1SuggestedSessionalWork(SW):

a. Assignments:

i. Discuss the potential for future development of each renewable energy resource in India.

ii. Analyze the challenges and opportunities for improving energy efficiency in India.

b. MiniProject:

i. Identify and analyze case studies of successful renewable energy projects (solar parks, wind farms, biogas plants)

c. OtherActivities(Specify):

Present your findings in a clear and concise manner, including maps, graphs, and data tables.

AE508.2: Students understanding Understand biogas technology, design & operate biogas plants, and calculate biogas yield. Evaluate power generation from biogas and analyze potential of utilizing waste for biogas production.

ApproximateHours

Item	AppX Hrs
Cl	5
LI	4
SW	2
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Understand the fundamental principles of biogas technology **SO2.2**Analyze the potential of biogas for generating power **SO2.3**Evaluate the benefits and challenges of using urban, municipal and industrial waste for biogas production **SO2.4**Gain the knowledge about Power generation from urban, municipal and industrial waste **SO2.5** Develop a critical understanding of the future prospects of biogas technology.	2.1 Performance evaluation of a fixed dome type biogas plant 2.2 Performance evaluation of floating drum type biogas plant	**Unit-2 Biogas technology and MSW power generation** 2.1 Biogas technology 2.2 Biogas mechanisms 2.3 Power Generation form biogas 2.4 Challenges of using urban, municipal, and industrial waste for biogas production 2.5 Power generation from urban, municipal and industrial waste	Collect data of installed capacity and potential of biogas plant in India from ministry of renewable energy.

SW-2 Suggested SessionalWork(SW):

a. **Assignments:**
   i. Research and summarize the different types of biogas digesters and their applications.
   ii. Analyze the challenges and opportunities associated with biogas power generation.

b. **MiniProject:**
   i. Analyze the energy efficiency of biogas power generation systems.

c. **OtherActivities(Specify):**

Design and build a cut section model of biogas plant.

AE508.3: Students acquire a comprehensive understanding of the principles, components, and functioning of steering systems of tractor as well as hydraulic system.

ApproximateHours

Item	AppX Hrs
Cl	5
LI	4
SW	2
SL	2
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 Understand the principles and applications of biogas technology in commercial settings **SO3.2**Analyze the design considerations and operational parameters of different commercial-sized biogas plants **SO3.3**Evaluate the feasibility and potential of biogas plants for power generation and waste management. **SO3.4**Explore various solar thermal and photovoltaic systems for power generation in commercial applications. **SO3.**5 Gain insights into the economic and environmental benefits of implementing biogas and solar energy systems.	3.1 To study about characteristics of solar photovoltaic panel 3.2 To study about evaluation of solar air heater/dryer	Unit-3:Biogas plant design and solar PV system 3.1 Design consideration for biogas plant design 3.2 Design & use of different commercial sized biogas plant 3.3 Factor affected for operational parameters of biogas plant 3.4 Solar Thermal system and application 3.5 photovoltaic Systems for power generation and the economic and environmental benefits	Research different types of commercial-sized biogas plants (e.g., fixed dome, floating drum, continuous feed) and their applications. Learn about solar PV system components, installation procedures, and grid integration techniques.

SW-3SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Design a basic biogas plant for a specific application (e.g., farm, restaurant, community center), considering factors like digester size, feedstock availability, biogas utilization, and waste management.
   ii. Calculate the heat gain from a solar thermal collector system based on solar irradiance, collector area, and system losses.

b. MiniProject:
   i. Conduct a solar resource assessment for your area and identify potential locations for solar thermal system installation

c. **OtherActivities(Specify):**
   i. Prepare Field visit to a commercial biogas plant or solar power installation.

AE508.4: Students Analyze design & operation of central receiver & distributed solar power plants. Understand OTEC, MHD, hydrogen fuel cell technology, and analyze their potential & challenges.

ApproximateHours

Item	AppX Hrs
Cl	6
LI	2
SW	2
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (S)
SO4.1 Students will gain the knowledge about central receiver solar power plant **SO4.2**Understandingtheconcept of distributed solar power generation **SO4.3** Students understand the concept of OTEC **SO4.4**Students know the the principle of MHD power generation and its potential **SO4.5**Gain the knowledge about fuel cell technologies for clean energy generation	4.1 Testing of diesel engine operation using dual fuel and gas alone	**Unit-4: Power generation form solar, OTEC, MHD and Fuel cell.** 4.1 Explain the working principle of a central receiver Chimney 4.2 Explain the concept of distributed solar power generation 4.3 Introduce the concept of OTEC . 4.4 Advantages of OTEC system 4.5 Explain the principle of MHD power generation 4.5 Advantages and disadvantages of MHD system 4.6 Explain the Fuel cell technology	i. Study the different type of fuel cell technology ii. Study the on stand alone and hybrid photovoltaic system

SW-4SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Research and compare the efficiency and cost of central receiver and distributed type solar power plants.
   ii. Presentation or poster explaining OTEC to a non-technical audience.

d. **MiniProject:**
   i. Design demo model of a hybrid power plant that combines MHD with another renewable energy source, such as solar or wind.

   e. **OtherActivities(Specify):**
   Design a presentation or poster explaining fuel cell technology to a general audience.

AE508.5: Students understand wind energy conversion system, biomass gasification &dendro thermal power generation and understand fuel cell technology & parameters.

Item	AppX Hrs
CL	6
LI	4
SW	2
SL	2
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (S)**
SO 5.1 Students should be able to explain the principles of wind power generation. **SO 5.2**Students should be able to understand the basic processes of biomass gasification and dendro thermal power generation. **SO 5.3**Students know the mini and micro-small hydropower plants **SO 5.4**Fuel cells and its associated parameters.	5.1Performance evaluation of biomass gasifier engine system (throatless & downdraft) 5.2 Estimation of calorific value of biogas & producer gas	**Unit5:Power generation from wind, biomass, hydel power and fuel cell.** 5.1 Explain the working principles of aero generators, including rotor design, blade pitch control, and power generation. 5.2 discuss the advantages and disadvantages of wind power as a renewable energy source. 5.3 Discuss the principles of biomass gasification and dendro thermal power generation. 5.4 Introduce the concept of hydropower and explain the different types of hydropower plants. 5.5 Focus on mini and micro-small hydropower plants (MHPHs) and their suitability for small-scale electricity generation. 5.6 Fuel cells and its associated parameters.	i. Recommend online resources like NREL (National Renewable Energy Laboratory) or IEA (International Energy Agency) websites for further exploration. ii. Explain the different type of turbine use in hydro power plant.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Students research and present on different types of wind turbine designs (e.g., horizontal axis, vertical axis). Enlist the IS code for tractor testing
   ii. Different type of fuels cells and its application

.

b. **Mini Project:**
   i. Visit the nearest hydro power plant and observe how to power generate and basic required components.

c. **Other Activities (Specify):**
   i. Discuss the environmental and economic benefits of wind power, as well as its challenges and limitations

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour(CL +LI+SW +SL)
AE508.1: Studentsanalyze energy scenario in India and identify conventional & non-conventional resources. Evaluate renewable energy options like solar, wind, biomass, and hydro, and discuss energy efficiency & security.	4	4	2	1	11
AE508.2: Students understanding the biogas technology, design & operate biogas plants, and calculate biogas yield. Evaluate power generation from biogas and analyze potential of utilizing waste for biogas production.	5	4	2	1	12
AE508.3: Design & select biogas plants, understand their operation & maintenance, and analyze performance. Design & implement solar thermal systems and understand principles & operation of solar photovoltaic systems.	5	4	2	2	13
AE508.4: Students Analyze design & operation of central receiver & distributed solar power plants. Understand OTEC, MHD, hydrogen fuel cell technology, and analyze their potential & challenges.	6	2	2	2	12
AE 508.5: Students understand Wind energy conversion system, biomass gasification & dendro thermal power generation and understand fuel cell technology & parameters.	6	4	2	2	14
TotalHours	**26**	**18**	**10**	**8**	**62**

Suggestion for End Semester Assessment (ESA)

CO	UnitTitles	MarksDistribution			Total Marks
		R	U	A	
CO-1	Energy options, consumption and its potential	01	02	02	05
CO-2	Biogas technology and MSW power generation	02	05	03	10
CO-3	Biogas plant design and solar PV system	03	07	05	15
CO-4	Power generation form solar, OTEC, MHD and Fuel cell.	02	08	05	15
CO-5	Power generation from wind, biomass, hydel power and fuel cell.	02	02	01	05
Total		10	24	16	50

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

The end of semester assessment for Renewable Power Sources 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit renewable energy lab and observe basic concept
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Non Conventional energy resources	Prof. B.H. Khan	McGraw Hill Education	Third Edition
2	Non Conventional energy resources	G G Rai	Khanna Publishers	Third Edition
3	Tractor and Their Power Units	Jhon B. Liljedahal Paul K. Turnquist David W. Smith Makoto Hoki	NationalCouncil forCementand BuildingMaterials	Fourth Indian Edition 1997
4	Automobile Engineering Vol-1	Kripal Singh	Standard Publisher Distributors	2020
5	Lecture note provided by Dept. of Agriculture Engineering ,AKS University, Satna.			

Curriculum Development Team

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Cos, POsandPSOsMapping

CourseTitle:B.Tech.Agricultural Engineering

CourseCode:22AE528

CourseTitle:Renewable Power Sources

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Students analyze energy scenario in India and identify conventional & non-conventional resources. Evaluate renewable energy options like solar, wind, biomass, and hydro, and discuss energy efficiency & security.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Students understanding Understand biogas technology, design & operate biogas plants, and calculate biogas yield. Evaluate power generation from biogas and analyze potential of utilizing waste for biogas production	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3:Design & select biogas plants, understand their operation & maintenance, and analyze performance. Design & implement solar thermal systems and understand principles & operation of solar photovoltaic systems	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Students Analyze design & operation of central receiver & distributed solar power plants. Understand OTEC, MHD, hydrogen fuel cell technology, and analyze their potential & challenges.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5: Students understand Wind energy conversion system, biomass gasification &dendro thermal power generation and understand fuel cell technology & parameters.	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	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)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-1:Students analyze energy scenario in India and identify conventional & non-conventional resources. Evaluate renewable energy options like solar, wind, biomass, and hydro, and discuss energy efficiency & security.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	Unit-1.0Energy options, consumption and its potential 1.1,1.2,1.3,1.4,1.5	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-2: Students understanding Understand biogas technology, design & operate biogas plants, and calculate biogas yield. Evaluate power generation from biogas and analyze potential of utilizing waste for biogas production	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2Biogas technology and MSW power generation 2.1,2.2,2.3,2.4,2.5,2.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-3: Design & select biogas plants, understand their operation & maintenance, and analyze performance. Design & implement solar thermal systems and understand principles & operation of solar photovoltaic systems	SO31S O3.2 SO3.3 SO3.4 SO3.5		Unit-3 : Biogas plant design and solar PV system 3.1,3.2,3.3,3.4,3.5,3.6	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 4: Students Analyze design & operation of central receiver & distributed solar power plants. Understand OTEC, MHD, hydrogen fuel cell technology, and analyze their potential & challenges.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4: Power generation form solar, OTEC, MHD and Fuel cell 4.1,4.2, 4.3, 4.4, 4.5, 4.6.	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 5: Students understand Wind energy conversion system, biomass gasification & dendro thermal power generation and understand fuel cell technology & parameters.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5:Power generation from wind, biomass, hydel power and fuel cell. 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code:	22CA621
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 impact the performance of programs

Course Outcomes (CO):

AE 601.1	Able to describe understand the fundamental concepts of programming languages and its types. Student will explain the core concept of C. Demonstrate familiarity with standard library functions and their usage. Role of compiler and interpreter and datatypes. Describe variables and operators in the C language.
AE 601.2	Gain proficiency in control flow structures for decision making and looping. Understand the scope and visibility of variables within programs. concepts of passing arguments to functions and returning values
AE 601.3	Able to describeone- and two-dimensionalArray. Fundamental concepts of pointer, structure and union
AE 601.4	Able to describe data structure and its types. Understand the stack and queue. Infix, prefix and postfix expression. Conversion from infix to postfix.
AE 601.5	Able to describe linked lists and various operations

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)	
PCC	22CA621	Computer Programming and Data Structures	1	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	22CA621	**Computer Programming and Data Structures** **(Theory)**	0	15	15	0	0	30	50	80
		Computer Programming and Data Structures **(Practical/Lab)**	15	0	0	5		20	0	20
		Total								**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.

AE 601.1 Able to describe understand the fundamental concepts of programming languages and its types. Student will explain the core concept of C. Demonstrate familiarity with standard library functions and their usage. Role of compiler and interpreter and data types. Describe variables and operators in the C language.

Approximate Hours

Item	CL	LI	SW	SL	Total
Approximate Hours	04	10	01	01	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understanding C language, data types, library function and operators SO1.2 Understanding compiler and interpreter	LI 1.1 Demonstrating IDE of C and role of compiler LI 1.2 Developing and executing simple programs LI 1.3 To print the simple message LI 1.4 To find area of circle LI 1.5 Developing and executing simple program using operators	**Unit-1 Programming languages** 1.1 Understand the program, programming language and its types. 1.2 Describe the Compiler and interpreter 1.3 Describe the different types of data types and operators 1.4 Understand the introduction and structure of c program.	1 Library function in C language

SW-1 Suggested Sessional Work (SW):
Assignments: - Explain about operators in C language
Mini Project:

Other Activities (Specify):

AE 601.2 Gain proficiency in control flow structures for decision making and looping. Understand the scope and visibility of variables within programs. Concepts of passing arguments to functions and returning values

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs	03	18	01	01	23

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Understanding control structure with examples SO2.2 Understanding array and its types SO2.3 Understanding string function with examples	LI 2.1 Creating programs using decision making statements such as if, if else and switch; LI 2.2 To check whether a number is positive, negative or zero LI 2.3 To check whether a number is Even or odd LI 2.4 To get the length of string LI 2.5 Developing program using loop statements while, do & for LI 2.6 To find largest no among three numbers. LI 2.7 Using local, global & external variables LI 2.8 To copy the value of one string to another LI 2.9 To Print prime number	**Unit-2Control Statements** 2.1 Describe the Conditional, jump and iterative statements 2.2 Describe the character and string function 2.3 Recursion. Scope and visibility of a variable.	1 What is function? Passing argument by value, by reference in function

SW-2 Suggested Sessional Work (SW):

a. Assignments:

Write a program to print Fibonacci series

b. Mini Project:

c. Other Activities (Specify):

AE 601.3 Able to describe one and two dimensional array. Fundamental concepts of pointer, structure and union.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs	03	18	01	01	23

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understanding array and its types SO3.2 Understanding structure and union with examples SO3.3 Understanding the using pointer variable	LI 3.1 To print one dimensional array LI 3.2 To two dimensional array LI 3.3 Developing structures and union LI 3.4 To store address a variable in pointer variable LI 3.5 To create, declare and initialize structure LI 3.6 To find the size of the union LI 3.7 To read and print an employee's details using structure LI 3.8 To find the size of the union LI 3.9 To read and print an student's details using union structure	**Unit-3 Arrays** 3.1 Describe the array and its types. 3.2 Describe the structure and union 3.3 Describe the pointer variable	1 Difference between structure and union

SW-3 Suggested Sessional Work (SW):

a. Assignments:

Write a program to print value of pointer variable.

b. Other Activities (Specify):

AE 601.4 Able to describe data structure and its types. Understand the stack and queue. Infix, prefix and postfix expression. Conversion from infix to postfix.

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs	04	10	00	01	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Understanding data structure and its types. SO4.2 Understanding stack and queue.	LI 4.1 To converting in to double data type LI 4.2 To insert and delete elements in a stack LI 4.3 To insert and delete elements in a queue LI 4.4 To write an algorithm push and pop operation in a stack LI 4.5 To write an algorithm rear and front operation in a queue	**Unit-4 Data Structure** 4.1 Describe the data structure and its types 4.2 Primitive operations on data structure. 4.3 Describe the infix, prefix and postfix 4.4 Describe the push and pop operation in stack and rear and front operation in queue	1 Difference between stack and queue

SW-4 Suggested Sessional Work (SW):

Assignments

Mini Project:

Other Activities (Specify):

AE 601.5 Able to describe linked lists and various operations

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs	01	O4	00	01	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understanding f Linked list and its types.	LI 5.1 To insertion and deletion operation in a linked list. LI 5.2 Write an algorithm singly and doubly link list	**Unit-5 Linked List** 5.1 Describe the Linked list and its types.	1 Static vs. dynamic data structure

SW-5 Suggested Sessional Work (SW):

a. Assignments:

b. Mini Project:

c. Other Activities (Specify):

Brief Hours suggested for the course outcomes

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total Hours(CL+SW+SL)
AE 601.1 Able to describe understand the fundamental concepts of programming languages and its types. Student will explain the core concept of C. Demonstrate familiarity with standard library functions and their usage. Role of compiler and interpreter and data types. Describe variables and operators in the C language.	04	10	01	01	16
AE 601.2 Gain proficiency in control flow structures for decision making and looping. Understand the scope and visibility of variables within programs. concepts of passing arguments to functions and returning values	03	18	01	01	23
AE 601.3 Able to describe one and two dimensional Array. Fundamental concepts of pointer, structure and union	03	18	01	01	23
AE 601.4 Able to describe data structure and its types. Understand the stack and queue. Infix, prefix and postfix expression. Conversion from infix to postfix.	04	10	00	01	15
AE 601.5 Able to describe linked lists and various operations	01	4	00	01	06
Total	**15**	**60**	**03**	**05**	**83**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Unit-1 Programming languages**	02	03	05	10
CO-2	**Unit-2Control Statements**	02	03	05	10
CO-3	**Unit-3 Arrays**	02	03	05	10
CO-4	**Unit-4 Data Structure**	02	03	05	10
CO-5	**Unit-5 Linked List**	02	03	05	10
Total		**10**	**15**	**25**	**50**

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

The end of semester assessment for Computer Programming and Data Structures 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 computer lab
5. Demonstration
6. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Instagram, WhatsApp, Mobile and other Online sources)
7. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Fundamentals of Computer Programming with c	Svetlin Nakov & Co		2013
2	Programming in C	E. Balagurusamy	Tata McGraw-Hill Publishing Company Limited, New Delhi	2008
3	Programming in BASIC	Balagurusamy, E	BPB Publications,	

Curriculum Development Team

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COs, POs and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering
Course Code: 22CA621
Course Title: Computer Programming and Data Structures

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO 2	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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1 Able to describe understand the fundamental concepts of programming languages and its types. Student will explain the core concept of C. Demonstrate familiarity with standard library functions and their usage. Role of compiler and interpreter and data types. Describe variables and operators in the C language.	1	2	1	1	2	2	1	1	1	1	2	1	2	3	2	2
CO2 Gain proficiency in control flow structures for decision making and looping. Understand the scope and visibility of variables within programs. concepts of passing arguments to functions and returning values	1	2	1	1	1	2	1	1	1	1	2	1	2	3	2	2
CO3 Able to describe one- and two-dimensional Array. Fundamental concepts of pointer, structure and union	1	2	1	1	1	2	1	1	1	1	2	1	2	3	2	2
CO4 Able to describe data structure and its types. Understand the stack and queue. Infix, prefix and postfix expression. Conversion from infix to postfix.	1	2	1	1	1	2	1	1	1	1	2	1	2	3	2	2
CO5 Able to describe linked lists and various operations	1	2	1	1	1	2	1	1	1	1	2	1	2	3	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Ma

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	CO1 Able to describe understands the fundamental concepts of programming languages and its types. Student will explain the core concept of C. Demonstrate familiarity with standard library functions and their usage. Role of compiler and interpreter and data types. Describe variables and operators in the C language.	SO1.1 SO1.2	As Mentioned along with the concern units	1,2,3,4,5	As Mentioned along with the concern units
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO2 Gain proficiency in control flow structures for decision making and looping. Understand the scope and visibility of variables within programs. concepts of passing arguments to functions and returning values	SO2.1 SO2.2 SO2.3		1,2,3	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO3 Able to describe one and two dimensional Array. Fundamental concepts of pointer, structure and union	SO3.1 SO3.2 SO3.3		1,2,3,4,5	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO4 Able to describe data structure and its types. Understand the stack and queue. Infix, prefix and postfix expression. Conversion from infix to postfix.	SO4.1 SO4.2		1,2,3,4	
PO:1,2,3,4,5,6,7,8,9,10,11,12 PSO:1,2,3,4	CO5 Able to describe linked lists and various operations	SO5.1		1	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code:	22AE622
Course Title:	**Farm Machinery and Equipment II**
Pre- requisite:	Student should have basic knowledge of applications of farm machineries used for intercultural operations, plant protection, harvesting and threshing operations with their types, constructional details, working and adjustments.
Rationale:	The students studying agricultural engineering should possess foundational understanding about the application of farm machineries and equipment in various field operations such as intercultural operations, plant protection applications, harvesting, threshing and root digging machineries of the different crops. Additionally, students ought to acquire fundamental insights of farm machineries care and Maintenance.

Course Outcomes:

AE 602.1: To equip the students with a comprehensive understanding of various aspects crucial to efficient pest management in agriculture.

AE 602.2: Students gain a comprehensive understanding of the essential tools and techniques for weed management and fertilizer application in agricultural intercropping systems.

AE 602.3: Students understanding of various aspects related to the efficient harvesting of crops. Through theoretical teachings and practical demonstrations, students will delve into harvesting methods, terminology, and the intricacies of different harvesting equipment.

AE 602.4: Students will enhance their knowledge of threshing equipment, particularly combine harvesters and threshers. The course will cover factors influencing thresher performance, enabling students to optimize operational efficiency.

AE 602.5: Students will possess a comprehensive understanding of root crop diggers, with a focus on potato and groundnut harvesting. Additionally, they will study cotton harvesting mechanisms, including cotton pickers and strippers, along with maize harvesting combines. Introduction to vegetables and fruit harvesting equipment and tools.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week) CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	Total Credits (C)
Progra mCore (PCC)	22AE622	Farm Machinery and Equipment II	3	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks): Progressive Assessment (PRA): Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
PCC	**22AE622**	**Farm Machinery and Equipment II (Theory)**	0	15	15	0	0	30	50	80
		Farm Machinery and Equipment II (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 602.1: To equip the students with a comprehensive understanding of various aspects crucial to efficient pest management in agriculture.

Approximate Hours

Item	AppX Hrs
CL	5
LI	8
SW	1
SL	2
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CL)**	**Self Learning (S)**
SO1.1 Understanding the functionalities and components of plant protection equipment. **SO1.2** Proficiency in determining application rates based on diverse crop requirements. **SO1.3** Identification of various nozzle types used in plant protection equipment. **SO1.4** Ability to conduct calibration procedures for optimizing machinery performance. **SO1.5** Application of calibration knowledge to enhance plant protection outcomes and resource efficiency. .	1.1 To Study sprayer sprayers, types, functional components. 1.2 To Study about of dusters, types and functional components. 1.3 Calculations for chemical application rates. 1.4 Study of nozzle types and spread pattern using patternator.	**Unit-1.0 Plant Protection Equipments** 1.1 Introduction to plant protection equipment 1.2 Classification of sprayers and Duster 1.3 Types of nozzles. 1.4 Application of nozzle according to crop 1.5 Calculations for calibration of sprayers and chemical application rates.	**1.** Research and familiarize oneself with the latest advancements in plant protection equipment technology through industry publications and online resources. 2. Engage in practical experimentation with different nozzle types and calibration techniques to deepen understanding and proficiency in optimizing machinery performance.

SW-1 Suggested Sessional Work (SW):

a. Assignments:
- **i.** Prepare chart for different types of plant protection equipment with their names, types, functions and components.

b. Mini Project:
- **i.** Conduct Comparative Analysis of Different types of Sprayers and Dusters with Their Efficiency in Pest Control for a particular Crop.

AE 602.2: Students gain a comprehensive understanding of the essential tools and techniques for weed management and fertilizer application in agricultural intercropping systems.

Approximate Hours

Item	AppX Hrs
Cl	7
LI	6
SW	2
SL	1
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO2.1 Understanding the functionalities of intercultural equipment like weeders and fertilizer applicators. **SO2.2** Familiarization with the operational applications of intercultural equipment in agricultural operations. **SO2.3** Proficiency in utilizing weeders and fertilizer applicators for intercultural operations. **SO2.4** Analyzing the significance of intercultural equipment in modern agricultural practices. **SO2.5** Demonstrating practical application skills with weeders and fertilizer applicators for efficient intercultural operations.	1.1 Familiarization with manual and powered weeding equipment and identification of functional components. 1.2 Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters. 1.3 Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters.	**Unit-2 Intercultural Operation Equipments** 2.1 Introduction to Intercultural Operations 2.2 Weeders and Their Functionality 2. Fertilizer Application Equipment Overview 2.4 Soil Cultivation Techniques 2.5 Explore crop thinning techniques and the equipment used to optimize plant spacing and yield potential. 2.6 Mulching and Mulching Equipment 2.7 Discover integrated pest management strategies and the equipment employed to minimize pest damage while maximizing crop yield.	1. Explore online resources and literature to deepen understanding of intercultural operations and investigate innovative techniques for efficient weed management and crop cultivation.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Prepare the list of implements and equipment used in intercultural operations.

b. Mini Project:

i. Demonstrating practical application skills with weeders and fertilizer applicators for efficient intercultural operations.

AE 101.3: Students understanding of various aspects related to the efficient harvesting of crops. Through theoretical teachings and practical demonstrations, students will delve into harvesting methods, terminology, and the intricacies of different harvesting equipment.

Approximate Hours

Item	AppX Hrs
Cl	5
LI	6
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (S)
SO3.1 Gain insights into the fundamental principles underlying harvesting operations in agriculture. **SO3.2** Develop practical skills and proficiency in operating various harvesting machinery, including combine harvesters, reapers, and binders. **SO3.3** Become acquainted with different harvesting methods and terminologies used in agricultural practices. **SO3.4** Learn about technical considerations essential for the efficient operation of harvesting machinery, ensuring optimal performance and productivity. **SO3.**5 Apply theoretical knowledge of harvesting principles and machinery operation in practical settings, enhancing understanding and competency in agricultural harvesting practices.	1.1 Study of various types of mowers, reaper, reaper binder. 1.2 Study of functional components of mowers and reapers 1.3 Familiarization with threshing systems, cleaning systems in threshers.	**Unit-3 : Study of harvesting operation** 3.1 harvesting methods & harvesting terminology 3.2 Study of mowers – types, constructional details, working and adjustments 3.3 Study of shear type harvesting devices 3.4 Study of reapers 3.5 Introduction to hay conditioning	Research online resources and industry publications to explore advancements in harvesting machinery technology and techniques. Engage in practical experimentation with harvesting machinery components to deepen understanding and proficiency through self-directed learning.

SW-3 Suggested Sessional Work (SW):

a) **Assignments:**

i. Enlist the all harvesting machines and equipment used in different crops and explains their functions and components.

b) **Mini Project:**

ii. Make a note on harvesting machines on special crops with their special features, their components and functions.

AE 602.4: Students will enhance their knowledge of threshing equipment, particularly combine harvesters and threshers. The course will cover factors influencing thresher performance, enabling students to optimize operational efficiency.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	4
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (S)
SO4.1 Develop comprehensive understanding of threshing equipment, particularly combine harvesters and threshers. **SO4.2** Gain insights into the efficiency and performance metrics associated with combine harvesters and threshers. **SO4.3** Familiarize with terminologies relevant to combine harvesters and threshers. **SO4.4** Analyze the role of threshing equipment in modern agricultural contexts. **SO4.**5 Apply knowledge to make informed decisions regarding the selection and operation of threshing equipment.	1.1 Familiarization with threshing systems, cleaning systems in threshers. 1.2 Calculations of losses in threshers. 1.3 Familiarization with functional units of Grain combines and their types 1.4 Calculations for grain losses in a combine	**Unit-4: Threshing Equipments** 4.1 Provide detailed overview of combine harvester and thresher functionalities and components. 4.2 Provide detailed overview of combine harvester and thresher functionalities and components. 4.3 Facilitate discussions on terminology associated with combine harvesters and threshers. 4.4 Organize case studies to analyze real-world applications of threshing equipment. 4.5 Engage students in problem-solving activities related to threshing equipment operation and maintenance. 4.6 Assign research projects to explore advancements in combine harvester and thresher technology.	**i.** Engage in literature review and online research to stay updated on the latest advancements and innovations in threshing equipment technology.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Conduct a comparative analysis of different combine harvester models, evaluating their efficiency, performance, and suitability for diverse agricultural contexts.

b. Mini Project: Design and implement a mini-project focused on optimizing the threshing efficiency of a combine harvester through innovative modifications or enhancements.

AE 602.5: Students will possess a comprehensive understanding of root crop diggers, with a focus on potato and groundnut harvesting. Additionally, they will study cotton harvesting mechanisms, including cotton pickers and strippers, along with maize harvesting combines. Introduction to vegetables and fruit harvesting equipment and tools.

Approximate Hours

Item	AppX Hrs
Cl	6
LI	6
SW	2
SL	2
Total	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO 5.1 Develop comprehensive understanding of root crop diggers, with emphasis on potato and groundnut harvesting techniques. **SO 5.2** Gain insights into cotton harvesting mechanisms, including cotton pickers and strippers. **SO 5.3** Understand the operation and functionality of maize harvesting combines. **SO 5.4** Familiarize with vegetables and fruit harvesting equipment and tools. **SO 5.5** Enhance knowledge of diverse agricultural practices through introduction to various harvesting techniques.	5.1 Study of root crop diggers and familiarization with the functional units and attachments 5.2 Familiarization with the working of cotton and maize harvesters. Familiarization with vegetable and fruit harvesters.	**Unit 5: Study of root crop diggers and vegetable harvesting techniques** 5.1 Study of root crop diggers – principle of operation, blade adjustment and approach angle, and calculation of material handled 5.2. Study of potato and groundnut diggers Study of Cotton harvesting – Cotton harvests mechanisms 5.4 study of cotton pickers and strippers 5.5 Study of maize harvesting combines 5.6 Introduction to vegetables and fruit harvesting equipment and tools..	i. Explore online resources and literature to deepen understanding of root crop diggers, cotton harvesting mechanisms, and maize harvesting combines. ii. Engage in practical experimentation with harvesting equipment components to enhance proficiency and skills through self-directed learning.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Conduct a comparative analysis of root crop diggers for potato and groundnut harvesting, evaluating their efficiency and suitability for different soil conditions.

ii. Research and prepare a report on the latest advancements in cotton harvesting technology, focusing on the impact of mechanization on cotton picker and stripper designs.

b. Mini Project:

Design and implement a mini-project aimed at improving the efficiency of maize harvesting combines through innovative modifications or optimization techniques.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE 101.1: Students grasp plant protection equipment concepts, determine application rates, identify nozzle types, and conduct calibration for optimized performance.	5	8	1	2	16
AE 101.2: Students learn about intercultural equipment like weeders and fertilizers, enhancing modern agricultural practices.	7	6	2	1	16
AE 101.3: Gain proficiency in operating harvesting machinery and understand technical aspects for efficient operations.	6	6	2	1	15
AE 101.4: Enhance knowledge of threshing equipment, enabling informed decision-making in agriculture.	6	4	2	1	13
AE 101.5: Develop comprehensive understanding of root crop diggers and study cotton and maize harvesting mechanisms.	6	6	2	2	16
Total Hours	**30**	**30**	9	**7**	**76**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Plant Protection Equipment, Application Rates and Types of nozzles.	02	02	01	05
CO-2	intercultural equipment like weeders and fertilizers	02	06	02	10
CO-3	harvesting machinery and understand technical aspects	03	07	05	15
CO-4	Enhance knowledge of threshing equipment	-	10	05	15
CO-5	Root crop diggers and study cotton and maize harvesting mechanisms.	02	02	01	05
Total		09	27	14	50

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

The end of semester assessment for Farm Machinery and Equipment -II 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to farm machinery equipments manufacturing plant.
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	Principles of Farm Machinery	Roy A. Kepner, Roy Barger, and E.L. Barger	AVI Publishing Company	Second Edition, 1972
2	Farm Machinery and Equipment	Harris Pearson Smith and L. H. Wilkes	McGraw-Hill Book Company	6th Edition (1968)
3	Farm Machinery	Claude Culpin	published by Wiley	12th Edition
4	Elements of Farm Machinery	A.C. Srivastava	Oxford & IBH Publishing Company Private, Limited	1991
5	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. (Agricultural Engineering)
Course Code: 22AE622
Course Title: Farm Machinery and Equipment 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
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	o make expertise in design and ngineering problem solving pproach in agriculture with roper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	bility to use the research based nnovative knowledge for ustainable development in gricultural Engineering.
CO1: Students grasp plant protection equipment concepts, determine application rates, identify nozzle types, and conduct calibration for optimized performance.	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2 : Students learn about intercultural equipment like weeders and fertilizers, enhancing modern agricultural practices.	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3: Gain proficiency in operating harvesting machinery and understand technical aspects for efficient operations.	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO4: Enhance knowledge of threshing equipment, enabling informed decision-making in agriculture.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO 5: Develop comprehensive understanding of root crop diggers and study cotton and maize harvesting mechanisms.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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)	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO-1: Students grasp plant protection equipment concepts, determine application rates, identify nozzle types, and conduct calibration for optimized performance.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	Unit-1.0 Plant Protection Equipment 1.1,1.2,1.3,1.4,1.5	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO-2: Students learn about intercultural equipment like weeders and fertilizers, enhancing modern agricultural practices.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5		Unit-2 Intercultural Operation Equipment 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO-3: Gain proficiency in operating harvesting machinery and understand technical aspects for efficient operations.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit-3 harvesting operations, encompassing principles, components, and functioning. 3.1, 3.2,3.3,3.4,3.5,3.6	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 4: Enhance knowledge of threshing equipment, enabling informed decision-making in agriculture.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit-4 : Threshing machines 4.1, 4.2, 4.3, 4.4, 4.5, 4.6.	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO 5: Develop comprehensive understanding of root crop diggers and study cotton and maize harvesting mechanisms.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5: Root crop diggers, cotton, maize, fruits and vegetable harvesting techniques 5.1,5.2,5.3,5.4,5.5,5.6	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code:	22AE623
Course Title:	Post Harvest Engineering of Horticultural Crops
Pre- requisite:	Students should have basic knowledge of different unit operation for processing of any horticultural product and also enhanced the quality of finished product.
Rationale:	The students studying Post Harvest Engineering of Horticultural Crops 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 horticultural food product that applicable for processing industry also.

Course Outcomes

AE603.1: Explain about concept of post harvest engineering of horticulture crop along with its importance.

AE603.2: Explain the basic concept of freezing and chilling of food along with different types of freezing equipments.

AE603.3: Acquired the knowledge for packaging o food products along with different types of applicable packaging material for horticulture products.

AE603.4: Explain the concept of food preservation along with different types of food preservation.

AE603.5: Explain about importance of post harvest management and also quality attribute of finished product.

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 (PCC)	22AE623	Post Harvest Engineering of Horticultural Crops	1	1	1	1	4	2

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial
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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PCC	**22AE623**	**Post Harvest Engineering of Horticultural Crops (Theory)**	0	15	15	0	0	30	50	80
		Post Harvest Engineering of Horticultural Crops (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE603.1: Explain about concept of post harvest engineering of horticulture crop along with its importance.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	3	4	1	1	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand the Importance of processing of fruits and vegetables, spices, condiments and flowers. SO1.2 Understand the Characteristics and properties of horticultural crops important for processing, Peeling: Different peeling methods and devices SO1.3 Understand the Slicing of horticultural crops: equipment for slicing SO1.4 Understand the shredding, crushing, chopping, juice extraction, SO1.5 Understand the Blanching: Importance and objectives; blanching methods, effects on food (nutrition, colour, pigment, texture),	1.1 Performance evaluation of peeler and slicer 1.2 Performance evaluation of juicer and pulper	**Unit 1: Processing Techniques and Characteristics of Horticultural Crops** 1.1 Importance of Processing Fruits, Vegetables, Spices, Condiments, and Flowers 1.2 Characteristics and Properties of Horticultural Crops Important for Processing 1.3 Peeling, Slicing, and Blanching of Horticultural Crops	1. Knowledge about processing of fruits and vegetable. 2. Detailed study about thermal heat treatment of fruits and vegetable

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Create a detailed report on the characteristics and properties of various horticultural crops that are important for processing. Include factors like texture, nutritional content, and perishability.

b. **Mini Project:** Design a small-scale processing line for a selected horticultural crop, incorporating peeling, slicing, and blanching steps.

c. **Other Activities:** Organize a visit to a local food processing plant or facility to observe real-world applications of peeling, slicing, and blanching techniques.

AE603.2: Explain the basic concept of freezing and chilling of food along with different types of freezing equipments.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	3	4	1	1	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand the Chilling and freezing: Application of refrigeration in different perishable food products, Thermophilic, mesophilic & Psychrophilic micro-organisms SO2.2 Understand the Chilling requirements of different fruits and vegetables, Freezing of food, freezing time calculations SO2.3 Understand the slow and fast freezing, Equipment for chilling and freezing (mechanical & cryogenic), SO2.4 Understand the Effect on food during chilling and freezing, Cold storage heat load calculations and cold storage design SO2.5 Understand the refrigerated vehicle and cold chain system, Dryers for fruits and vegetables, Osmo-dehydration,	2.1 Performance evaluation of blanching equipment 2.2 Testing adequacy of blanching	**Unit 2: Cold Chain Management and Preservation Techniques for Perishable Foods** 2.1 Overview of Refrigeration & technology and its importance in preserving perishable food products. 2.2 Freezing Technology include freezing time calculations, slow and fast freezing, Equipment for chilling and freezing (mechanical & cryogenic) 2.3 overview of Cold Storage and Cold Chain Systems also dryers.	1. Knowledge about chilling and freezing 2. Detailed study about heat load calculation

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Analyze a case study of a cold chain system used by a major food company. Discuss the effectiveness and any areas for improvement.

b. **Mini Project:** Design a cold storage facility for a specific type of fruit or vegetable. Include calculations for heat load and storage capacity.

c. **Other Activities:** Organize a visit to a local cold storage facility or a food processing plant to see the chilling and freezing processes in action.

AE603.3: Acquired the knowledge for packaging o food products along with different types of applicable packaging material for horticulture products.

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	3	4	1	1	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Understand the Packaging of horticultural commodities, Packaging requirements SO3.2 Understand the Different types of packaging materials commonly used for raw and processed fruits and vegetables products SO3.3 Understand the bulk and retailpackages and packaging machines,handling and transportation of fruits and vegetables SO3.4 Understand the Pack house technology, Minimal processing, Common methods of storage, Low temperature storage SO3.5 Understand the evaporative cooled storage, Controlled atmospheric storage, Modified atmospheric packaging,	3.1Study of cold storage and its design 3.2 Study of CAP and MAP storage	**Unit 3 Packing & storage technologies** 3.1 Packaging of horticultural commodities 3.2 Different types of packaging materials 3.3 Common methods of storage, Low temperature storage	1. Knowledge about packaging technology 2. Knowledge about different types of packaging material

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Compare the properties (light transmittance, heat, moisture and gas proof, mechanical strength) of at least three different types of packaging materials used for horticultural commodities. Discuss the advantages and disadvantages of each material.

b. **Mini Project:** Develop a comprehensive packaging solution for a specific horticultural commodity

c. **Other Activities:** Invite an industry expert to give a lecture on the latest advancements in packaging technologies for horticultural commodities. Encourage students to prepare questions and engage in a Q&A session.

AE603.4: Explain the concept of food preservation along with different types of food preservation

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	3	4	1	1	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Understand the Preservation Technology, General methods of preservation of fruits and vegetables, SO4.2 Understand the Brief description and advantages and disadvantages of different physical/ chemical and other methods of preservation SO4.3 Understand the Flowcharts for preparation of different finished products,	4.1 Minimal processing of vegetables 4.2 Preparation of value added products	**Unit 4 Preservation Technology** 4.1 Preservation Technology, 4.2 Methods of preservation 4.3 Flowcharts for preparation of different finished products	1. Knowledge about Preservation technique 3. Knowledge about method of preservation

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Review a research paper on the latest advancements in preservation technologies for fruits and vegetables. Summarize the findings and discuss their implications.

b. **Mini Project:** Develop and propose an innovative preservation method for a specific fruit or vegetable. Include a detailed explanation of how it works, its benefits, and any potential drawbacks.

c. **Other Activities:** Conduct an experiment to test the effectiveness of a preservation method (e.g., dehydration) on the quality and shelf life of a fruit or vegetable.

AE603.5: Explain about importance of post harvest management and also quality attribute of finished product

Approximate Hours

Items	CL	LI	SW	SL	Total
Approx. Hours	3	2	1	1	7

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand the Important parameters and equipment used for different unit operations SO5.2 Understand the Post harvest management and equipment for spices and flowers SO5.3 Understand the Quality control in Fruit and vegetable processing industry. Food supply chain.	5.1 Visit to fruit and vegetable processing industry 5.2 Visit to spice processing plant	**Unit 5 Post-Harvest Management** 5.1 equipment used for different unit operations 5.2 Quality control in Fruit and vegetable 5.3 Processing industry. Food supply chain	1. Knowledge about different types of processing equipment 3. Knowledge about quality control in food

SW-1 Suggested Sessional Work (SW):

a. **Assignments**: Analyze the principles and practices of quality control in the fruit and vegetable processing industry.

b. **Mini Project:** Develop a comprehensive post-harvest management plan for either spices or flowers. Include strategies for harvesting, handling, processing, storage, and transportation.

c. **Other Activities:** Invite a quality control expert from the food processing industry to deliver a lecture on the importance of quality control in ensuring food safety and meeting regulatory standards.

Brief of Hours suggested for the Course Outcome

Course Outcomes	CL	LI	SW	SL	Total hour (Cl+L1+SW +SL)
AE603.1: Explain about concept of post harvest engineering of horticulture crop along with its importance.	3	4	1	1	9
AE603.2: Explain the basic concept of freezing and chilling of food along with different types of freezing equipments.	3	4	1	1	9
AE603.3: Acquired the knowledge for packaging o food products along with different types of applicable packaging material for horticulture products.	3	4	1	1	9
AE603.4: Explain the concept of food preservation along with different types of food preservation.	3	4	1	1	9
AE603.5: Explain about importance of post harvest management and also quality attribute of finished product	3	4	1	1	9
Total Hours	15	20	5	5	45

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Processing Techniques and Characteristics of Horticultural Crops	03	03	01	07
CO-2	Cold Chain Management and Preservation Techniques for Perishable Foods	03	05	02	10
CO-3	Packing & storage technologies	02	06	03	11
CO-4	Preservation Technology	03	04	04	11
CO-5	Post-Harvest Management	02	04	05	11
	Total	15	20	15	50

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

The end of semester assessment for post harvest engineering of horticultural crops (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
- Demonstration
- ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Instagram, WhatsApp, Mobile and other Online sources)
- Brainstorming

Suggested Learning Resources:

(a) **Books**:

S. No.	Title	Author	Publisher	Edition & Year
1	**Fruit Processing**	**Arthey, D. and Ashurst, P. R**	Chapman and Hall, New York	1966
2	**Postharvest physiology, handling and utilization of tropical and subtropical fruits and vegetables**	**Pantastico, E.C.B .**	AVI Pub. Co., New Delhi.	1975
3	**Postharvest Technology of fruits and vegetables**	**Pandey, R.H.**	Saroj Prakashan, Allahabad	1997

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Cos, POs and PSOs Mapping

Course Title: B. Tech (Agricultural Engineering)
Course Code: 22AE623
Course Title: Post Harvest Engineering of Horticultural Crops

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in
AE603.1 Explain about concept of post harvest engineering of horticulture crop along with its importance.	3	2	3	1	1	3	2	3	3	3	1	2	3	3	3	2
AE603.2 Explain the basic concept of freezing and chilling of food along with different types of freezing equipments.	3	2	2	1	3	3	2	1	2	1	1	1	3	3	2	2
AE603.3 Acquired the knowledge for packaging o food products along with different types of applicable packaging material for horticulture products.	3	3	1	1	3	2	1	1	2	2	3	3	3	2	3	3
AE603.4 Explain the concept of food preservation along with different types of food preservation.	3	1	3	1	3	2	3	1	3	3	1	3	3	3	2	2
AE603.5 Explain about importance of post harvest management and also quality attribute of finished product.	3	2	2	1	3	2	2	3	2	2	1	1	3	2	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	**AE603.1** Explain about concept of post harvest engineering of horticulture crop along with its importance**.**	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1 1.2	Unit-1.0 Processing Techniques and Characteristics of Horticultural Crops 1.1,1.2,1.3	As Mentioned along with the concern units
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE603.2** Explain the basic concept of freezing and chilling of food along with different types of freezing equipments..	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	2.1 2.2	Unit-2 Cold Chain Management and Preservation Techniques for Perishable Foods 2.1, 2.2, 2.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	**AE603.3** Acquired the knowledge for packaging o food products along with different types of applicable packaging material for horticulture products.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	3.1 3.2	Unit-3 : Packing & storage technologies 3.1, 3.2,3.3,3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	AE603.4 Explain the concept of food preservation along with different types of food preservation.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	4.1 4.2	Unit-4 : Preservation Technology 4.1, 4.2,4.3	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	AE603.5 Explain about importance of post harvest management and also quality attribute of finished product.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	5.1 5.2	Unit 5: Post-Harvest Management 5.1,5.2,5.3	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code:	22AE624
Course Title:	**Water Harvesting and Soil Conservation Structures**
Pre-requisite:	Student should have effectively design, implement, and maintain water harvesting and soil conservation structures to mitigate erosion, enhance water availability, and promote sustainable land use practices.
Rationale:	Water Harvesting and Soil Conservation Structures is rooted in their ability to address interconnected challenges related to water, soil, agriculture, and environmental sustainability. By integrating these practices into land management strategies, societies can build resilience, safeguard natural resources, and promote sustainable development for current and future generations

Course Outcomes:

AE604.1:	Students will Understand principles, techniques, and issues of water harvesting.
AE 604.2:	Students will learn Design farm ponds, tanks, and percolation ponds; Implement nala bunds for water conservation.
AE 604.3:	Design permanent structures for soil erosion control; Implement check dams and drop spillways for gully control.
AE 604.4:	Perform hydrologic, hydraulic, and structural design; understand the applicability and design criteria of drop and box-type inlet spillways.
AE 604.5:	Design chute and drop inlet spillways; Evaluate design criteria and limitations of SAF stilling basin.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PCC	**22AE624**	Water Harvesting and Soil Conservation Structures	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)	(ESA)	(PRA+ ESA)
PCC	22AE624	**Water Harvesting and Soil Conservation Structures (Theory)**	0	15	15	0	0	30	50	80
		Water Harvesting and Soil Conservation Structures (Practical/Lab)	15	0	0	5	0	20	0	20
		Total								**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.

AE 604.1: Understand principles, techniques, and issues of water harvesting.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the principles, importance, and issues related to water harvesting. **SO1.2** Classify water harvesting techniques based on source, storage, and use. **SO1.3 Describe** short-term runoff harvesting techniques, including terracing and bunding, rock, and ground catchments. **SO1.4**Explain long-term harvesting techniques, their purpose, and design criteria.	• Study of different types of farm ponds. • Computation of storage capacity of embankment type of farm ponds. • Design of dugout farm ponds.	**Unit-1.0** **1.Water harvesting - principles**, , importance **2.Water harvesting -**issues. 3.Water harvesting techniques - classification based on source storage and use. **4. Runoff harvesting –** short-term and long-term techniques **5. Short-term harvesting techniques** - terracing and bunding**, ,**rock and ground catchments **6.Long-term harvesting techniques** - purpose and design criteria.,	1. Scope and importance of Water harvesting - principles

Assignments:

Discuss the different types Long-term harvesting techniques.

Enlist various Short-term harvesting techniques.

Mini Project:

Classification and applications of various Runoff harvesting methods.

AE 604.2: Design farm ponds, tanks, and percolation ponds; Implement nala bunds for water conservation.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	8	6	2	1	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Identify different types of structures such as farm ponds, tanks, and subsurface dykes used for water harvesting. **SO2.2** Describe the components, site selection, design criteria, and capacity of farm ponds. **SO2.3** Explain the design and construction details of percolation ponds. **SO2.4** Discuss the design considerations of nala bunds.	1.1 Design of percolation pond and nala bunds. 1.2 Runoff measurement using H-flume. 1.3 Exercis e on hydraulic jump.	**Unit-2.0** 1.Structures - farm ponds - dug-out 2.embankment reservoir types, 3.tanks and subsurface dykes 4.Farm pond - components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways. 5. cost estimation and construction. 6. Percolation pond - site selection, 7. design and construction details. 8. Design considerations of nala bunds.	1. Scope and importance of embankment reservoir. .

Assignments:

1. Analyze a real-world case study of a Percolation pond - site selection, design.

Mini Project:

Process Design Project: describe the components, site selection, design criteria, and capacity of farm ponds.

AE 604.3: Design permanent structures for soil erosion control; Implement check dams and drop spillways for gully control.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Understand the introduction, classification, and functional requirements of soil erosion control structures. **SO3.2** Describe permanent structures for soil conservation and gully control, including check dams, drop, chute, and drop inlet spillways.. **SO3.3** Explain the design requirements, planning for design, and design procedures of these structures.	1.1 Exercise on energy dissipation in water flow. 1.2 Hydrologic, hydraulic and structural 1.3 design of drop spillway and stability analysis.	**Unit-3.0** 1. **Soil erosion control structures -** introduction, classification and **2 Soil erosion control structures.** Functional requirements**.** **3. Permanent** structures for soil conservation **4** gully **control -** check dams **5.Drop, chute** and drop inlet spillways **6. Design requirements,** planning for design, design procedures.	1. Evaluate the Permanent structures classification.

Assignments:

- Describe permanent structures for soil conservation drop inlet spillways in detail.
- Define the design procedures of check dams structures.

Mini Project:

Prepare the design chat of different types of spillway.

AE 604.4: Perform hydrologic, hydraulic, and structural design; Understand the applicability and design criteria of drop and box-type inlet spillways.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	6	2	1	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Learn about hydrologic, hydraulic, and structural design principles for water harvesting structures. **SO4.2** Explain the concept of hydraulic jump and its application. **SO4.3** Describe the types of drop spillways, including straight drop and box-type inlet spillways, and their design criteria. **SO4.4** Understand the structural components and functions of straight apron and stilling basin outlet.	1.1 Design of SAF stilling basins in chute spillway 1.2 Hydrologic, hydraulic and structural design of drop inlet spillway 1.3 Design of small earthen embankment structures.	**Unit-4.0** 1. **Hydrologic, hydraulic** and structural design and stability analysis Canning, **2. Hydraulic jump** and its application. **3.Drop spillway - applicability, types -** straight drop, box-type inlet **4.Spillwaysdescription**,functional use, **5. Spillways description** advantages and disadvantages, **6. Straight apron** and stilling basin outlet, structural components and functions.	1. Scope and Importance of Drop spillway.

Assignments:

- Explain the concept of Drop spillway and its application.
- Define the design principles for water harvesting structures.

Mini Project:

- Design various structural components earthen embankment structures.

AE 604.5: Design chute and drop inlet spillways; Evaluate design criteria and limitations of SAF stilling basin.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	4	6	2	2	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Describe chute spillways, their components, and energy dissipaters. **SO5.2 Explain** the design criteria of Saint Antony Falls (SAF) stilling basin and its limitations. **SO5.3 Discuss** the description, functional use, and design criteria of drop inlet spillways. .	Practice on softwares for design of soil and water conservation structures Field visit to watershed project areas treated soil and water conservation measures / structures.	**Unit-5.0** **Chute spillway -** description, components, energy dissipaters, **design criteria** of Saint Antony Falls (SAF) stilling basin and its limitations **Drop inlet spillway** - description, functional use and design criteria.	1. Understand the description and components of a chute spillway, including its purpose and construction. 2. Explore the design criteria specific to Saint Anthony Falls (SAF) stilling basin, including its dimensions, flow characteristics, and hydraulic considerations.

Assignments:

- Explore the design criteria for drop inlet spillways, including factors such as flow rate, inlet geometry, and outlet structure.
- Learn about different design configurations and considerations for optimizing the performance of drop inlet spillways in various hydrological conditions.

Mini Project:

- Design and Analysis of Chute Spillway and Drop Inlet Spillway.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL +LI+ SW + SL)
AE604.1 Students will Understand principles, techniques, and issues of water harvesting.	6	6	2	1	15
AE604.2 Students will learn Design farm ponds, tanks, and percolation ponds; Implement nala bunds for water conservation.	8	6	2	1	17
AE604.3 Design permanent structures for soil erosion control; Implement check dams and drop spillways for gully control.	6	6	2	1	15
AE604.4 Perform hydrologic, hydraulic, and structural design; Understand the applicability and design criteria of drop and box-type inlet spillways.	6	6	2	1	15
AE604.2 Design chute and drop inlet spillways; Evaluate design criteria and limitations of SAF stilling basin.	4	6	2	2	14
Total Hours	**30**	**30**	**10**	**6**	**76**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Water harvesting -**	04	05	01	10
CO-2	**Structures -**	04	04	02	10
CO-3	**Soil erosion control structures**	05	04	03	11
CO-4	**Hydrologic, hydraulic and structural design**	04	05	03	12
CO-5	**Chute spillway**	03	02	02	07
Total		**20**	**20**	**10**	**50**

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

The end of semester assessment Water Harvesting and Soil Conservation Structures 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to milk processing plants
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/s	Publisher	Edition&Year
1	Manual of Soil and Water Conservation Practices.	Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi	. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi	1996
2	Principles of Agricultural Engineering. Volume II	Michael, A.M. and T.P. Ojha	4th Edition, Jain Brothers, New Delhi.	2003
3	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
4	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering
Course Code: 22AE624
Course Title: Water Harvesting and Soil Conservation Structures

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Students will Understand principles, techniques, and issues of water harvesting.	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO-2 Students will learn Design farm ponds, tanks, and percolation ponds; Implement nala bunds for water conservation.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO-3 Design permanent structures for soil erosion control; Implement check dams and drop spillways for gully control.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Perform hydrologic, hydraulic, and structural design; Understand the applicability and design criteria of drop and box-type inlet spillways.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 Design chute and drop inlet spillways; Evaluate design criteria and limitations of SAF stilling basin.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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	CO-1 Students will Understand principles, techniques, and issues of water harvesting.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	AE 604.1: Water harvesting - 1.1,1.2,1.3,1.4,1.5,1.6	As Mentioned along with the concern units
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4	CO-2 Students will learn Design farm ponds, tanks, and percolation ponds; Implement nala bunds for water conservation.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 604.2: Structures - 1.1,1.2,1.3,1.4,1.5,1.6 ,1.7,.1.8	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4	CO-3 Design permanent structures for soil erosion control; Implement check dams and drop spillways for gully control.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 604.3: Soil erosion control structures. 1.1,1.2,1.3,1.4,1.5,1.6	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4	CO-4 Perform hydrologic, hydraulic, and structural design; Understand the applicability and design criteria of drop and box-type inlet spillways.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 604.4: Hydrologic, hydraulic and structural design. 1.1,1.2,1.3,1.4,1.5,1.6	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4	CO-5 Design chute and drop inlet spillways; Evaluate design criteria and limitations of SAF stilling basin.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 604.5: Chute spillway 1.1,1.2,1.3,1.4,	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme
Semester-VI

Course Code:	22AE625
Course Title:	**Groundwater, Wells and Pumps**
Pre-requisite:	To successfully understand designing and constructing wells for efficient water extraction.
Rationale:	Groundwater is a critical resource for drinking water, irrigation, and industrial use. This course provides students with the knowledge and skills necessary to understand, manage, and utilize groundwater resources effectively.

Course Outcomes:

AE 605.1: Understand groundwater dynamics & well behavior

AE 605.2: Explore well types, design, drilling, & completion

AE 605..3: Analyze aquifer parameters, well impact, & recharge strategies

AE 605..4: Select, install, & maintain water lifting devices (pumps)

AE 605.5 Design & optimize pumps including advanced types

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 (PCC)	22AE625	Groundwater, Wells and Pumps	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PCC	22AE622	**Groundwater, Wells and Pumps (Theory)**	0	15	15	0	0	30	50	80
		Groundwater, Wells and Pumps (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE605.1: Understand groundwater dynamics & well behavior

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	4	2	2	2	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Explain the occurrence and movement of groundwater. **SO1.2**Identify and differentiate between different types of aquifers. **SO1.3**Classify wells based on various criteria. **SO1.4**Analyze steady and transient flow into different well types.	**1.** Verification of Darcy's Law.	**Unit-1.0 Groundwater Occurrence and Movement** **1.1** Occurrence and movement of ground water **1.2** Classification of wells **1.3** Steady and transient flow into partially, fully and non-penetrating **1.4** Open wells	**1.** Read textbook chapters and journal articles on groundwater occurrence, movement, aquifers, and well types. **2.** Watch online lectures and documentaries on the same topics. **3.** Explore interactive simulations and models of groundwater flow.

SW-1 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Research and compare different aquifer types found in your region.
   ii. Analyze case studies of well failures and identify contributing factors.
   iii. Calculate theoretical steady-state flow into a well using provided formulas.

b. **Mini Project:**
   i. Develop a physical model of an aquifer and demonstrate groundwater flow behaviour.

c. **Other Activities (Specify):**
   i. Create an infographic explaining different well types and their suitability for various applications.

AE605.2: Explore well types, design, drilling, & completion

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	9	4	2	2	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Describe various types of bore wells commonly used in the region. **SO2.2**Design an open well based on specific requirements. **SO2.3**Evaluate different groundwater exploration techniques. **SO2.4**Compare and contrast methods of drilling wells (percussion, rotary, reverse rotary). **SO2.5**Design and assemble a well screen and gravel pack. **SO2.6**Explain the completion and development process of a well.	**1.** Study of different drilling equipment **2.** Sieve analysis for gravel and well screens design.	**Unit-2Bore Wells Design and Exploration Techniques** **1.1** Familiarization of various types of bore wells common in the state **1.2** Design of open well, **1.3** Groundwater exploration techniques, **1.4** Methods of drilling of wells, **1.5** Percussion, **1.6** Rotary, reverse rotary, **1.7** Design of assembly and gravel pack, **1.8** Installation of well screen, **1.9** Completion and development of well	**1.** Familiarize yourself with common bore well types in your state through research and field visits. **2.** Study open well design principles and construction techniques. **3.** Learn about different groundwater exploration methods and their practical applications.

SW-2 Suggested Sessional Work (SW):

Assignments:

- **i.** Compare and contrast different well drilling methods based on cost, efficiency, and suitability for specific geological conditions.
- **ii.** Draft a detailed plan for open well construction in a hypothetical scenario.
- **iii.** Research a specific groundwater exploration technique and present its key characteristics and limitations.

b. Mini Project:

- **i.** Design and build a small-scale model of a bore well, highlighting its key components and functionalities.

c. Other Activities(Specify):

- **i.** Create a presentation summarizing the pros and cons of different well types for various water needs.

AE605.3: Analyze aquifer parameters, well impact, & recharge strategies

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	10	4	2	2	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Apply various methods (Theis, Jacob & Chow, Recovery) to determine aquifer parameters. **SO3.2** Analyze well interference and its impact on groundwater systems. **SO3.3** Evaluate the potential of multiple well systems. **SO3.4** Estimate groundwater potential based on surface and subsurface exploitation. **SO3.5** Assess the quality of groundwater and potential remediation strategies. **SO3.6** Develop plans for artificial groundwater recharge, including modeling and project formulation.	**1.** Estimation of specific yield and specific retention; **2.** Drilling of a tube well.	**Unit-3: Groundwater Hydraulics and Aquifer Parameters** **3.1** Groundwater hydraulics **3.2** Determination of aquifer parameters by different method **3.3** Theis recovery method **3.4** Well interference **3.5** Multiple well systems **3.6** Surface and subsurface exploitation **3.7** Estimation of ground water potential, **3.8** Quality of ground water, **3.9** Artificial groundwater recharge planning, modeling **3.10** Ground water project formulation.	**1.** Understand the concept of well interference and its implications for multiple well systems. **2.** Explore techniques for surface and subsurface water exploitation and groundwater potential estimation. **3.** Learn about groundwater quality issues and strategies for artificial recharge planning and modeling.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Analyze real-world data to estimate aquifer parameters using chosen methods.
   ii. Simulate well interference scenarios and assess potential impacts on surrounding wells.
   iii. Research and evaluate artificial recharge techniques suitable for your region.

b. **Mini Project:**
   i. Develop a proposal for a small-scale artificial groundwater recharge project in your area.

c. **Other Activities (Specify):**
   i. Create a map illustrating groundwater potential zones and potential risks of overexploitation.

AE 605.4: Select, install, & maintain water lifting devices (pumps)

Approximate Hours

Item	Cl	LI	SW	SL	Total
AppX Hrs.	8	2	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Select appropriate water lifting devices (pumps) based on specific needs. **SO4.2** Install and troubleshoot pumping systems effectively. **SO4.3** Apply principles of centrifugal pump design to optimize performance	**1.** Measurement of water level and drawdown in pumped wells.	**Unit-4: Pumping Systems and Machinery** **4.1** Pumping Systems **4.2** Water lifting devices **4.3** Different types of pumping machinery **4.4** Classification of pumps **4.5** Component parts of centrifugal pumps **4.6** Pump selection **4.7** Installation and trouble-shooting **4.8** Design of centrifugal pumps	**1.** Study different types of water lifting devices, including centrifugal pumps, their classification, and key components. **2.** Gain practical knowledge on pump selection based on specific water requirements and system characteristics. **3.** Learn proper pump installation procedures and troubleshooting techniques. **4.** Explore the principles of centrifugal pump design.

SW-4SuggestedSessionalWork(SW):

a. **Assignments:**
   i. Analyze pump performance curves and select suitable pumps for various scenarios.
   ii. Research and compare different pump maintenance practices.
   iii. Design a basic centrifugal pump model using CAD software.

b. **Mini Project:**
   i. Conduct a field demonstration of pump installation and operation, showcasing troubleshooting skills.

c. **Other Activities (Specify):**
   i. Create a user-friendly guide for selecting and maintaining pumps for different applications.

AE 605.5: Design & optimize pumps including advanced types

Approximate Hours

Item	CL	LI	SW	SL	Total
AppX Hrs.	8	2	2	2	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Interpret pump performance curves and analyze the impact of speed on various parameters. **SO5.2**Explain the effect of changing impeller dimensions on pump performance. **SO5.3**Compare the characteristics of hydraulic rams, propeller pumps, and mixed flow pumps. **SO5.4**Describe priming methods and self-priming devices for pumps. **SO5.5**Identify and explain the applications of roto-dynamic pumps for specific purposes (deep well turbine, submersible).	**1.** Study of artificial ground water recharge structures.	**Unit5:Pump Performance and Specialized Pumping Devices** **5.1** Pump performance curves, **5.2** Effect of speed on head capacity **5.3** Power capacity and efficiency curves **5.4** Effect of change of impeller dimensions on performance characteristics **5.5** Hydraulic ram **5.6** Propeller pumps and mixed flow pumps and their performance characteristics **5.7** Priming and self-priming devices **5.8** Roto-dynamic pumps	**1.** Master the interpretation of pump performance curves, including the effects of speed, impeller dimensions, and head/capacity/power relationships. **2.** Study advanced pump types like hydraulic rams, propeller pumps, and mixed flow pumps. **3.** Understand the principles of priming and self-priming devices. **4.** Explore special-purpose rotodynamic pumps like deep well turbine and submersible pumps.

SW-5 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Develop an optimization strategy for existing pump installations based on performance curves.
   ii. Research and present a case study on a specific advanced pump type and its applications.
   iii. Design a small-scale prototype of a non-traditional water lifting device.

b. **Mini Project:**
   i. Create a comprehensive presentation on the selection, design, and optimization of pumps for various water needs.

c. **Other Activities (Specify):**
   i. Develop a mobile app or web tool for pump selection and performance analysis.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
AE605.1: Understand groundwater dynamics & well behavior	4	2	2	8
AE605.2: Explore well types, design, drilling, & completion	9	2	2	13
AE605.3: Analyze aquifer parameters, well impact, & recharge strategies	10	2	2	14
AE 605.4: Select, install, & maintain water lifting devices (pumps)	8	2	2	12
AE 605.5:Design & optimize pumps including advanced types	8	2	2	12
Total Hours	39	10	10	59

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Groundwater Occurrence and Movement	03	01	01	05
CO-2	Bore Wells Design and Exploration Techniques	02	06	02	10
CO-3	Groundwater Hydraulics and Aquifer Parameters	03	07	05	15
CO-4	Pumping Systems and Machinery	-	10	05	15
CO-5	Pump Performance and Specialized Pumping Devices	03	02	-	05
Total		11	26	13	50

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

The end of semester assessment for Groundwater, Wells Pumps 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Krishi Vigyan Kendra
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	Ground water Hydrology	H.M. Raghunath	New Age International Publisher	2007
2	Wells and Pumps Engineering	S.D. Khepar and A.M. Michael	Tata McGraw-Hill Publishing	2008
3	Pump: Theory & Practices	V.K. Jain	Galgotic	1987
4	Irrigation Theory and Practical	A.M. Michael	Vikas Publishing House	2009
5	Ground Water Engineering	D.K. Todd	John Wiley & Sons	2004
6	Assessment of Ground Water Resources	K.R. Karanth	Karanth K ... Publication	2003
5	https://ecourses.icar.gov.in/			
7	Lecture note provided by Dept. of Agricultural Engineering, AKS University, Satna.			

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering

Course Code: 22AE625

Course Title: Groundwater, Wells and Pumps

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1:Understand groundwater dynamics & well behavior	1	1	2	2	3	2	3	2	2	1	3	2	2	3	3	1
CO 2:Explore well types, design, drilling, & completion	1	1	2	2	1	2	3	2	1	1	2	2	2	2	2	1
CO3:Analyze aquifer parameters, well impact, & recharge strategies	2	2	1	1	1	2	2	2	1	2	1	2	1	1	2	2
CO 4: Select, install, & maintain water lifting devices (pumps)	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO5:Design & optimize pumps including advanced types	-	-	-	1	1	3	3	3	1	1	2	2	3	3	1	3

Legend:1–Low,2–Medium,3–High

Course Curriculum Map:

Pos & PSOs No.	Cos No. & Titles	SOsNo.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO-1:Understand groundwater dynamics & well behavior	SO1.1 SO1.2 SO1.3 SO1.4	As Mentioned along with the concern units	Unit-1.0 Groundwater Occurrence and Movement 1.1,1.2,1.3,1.4	As Mentioned along with the concern units
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO 2 : Explore well types, design, drilling, & completion	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6		Unit-2 Bore Wells Design and Exploration Techniques 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4	CO3 : Analyze aquifer parameters, well impact, & recharge strategies	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6		Unit-3 Groundwater Hydraulics and Aquifer Parameters 3.1,3.2,3.3,3.4,3.5, 3.6,3.7,3.8,3.9,3.10	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2	CO 4: Select, install, & maintain water lifting devices (pumps)	SO4.1 SO4.2 SO4.3		Unit-4 Pumping Systems and Machinery 4.1,4.2,4.3,4.4, 4.5,4.6,4.7,4.8	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 5: Design & optimize pumps including advanced types	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit5 Pumping Systems and Machinery 5.1,5.2,5.3,5.4,5.5	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code: 22AE678

Course Title: **Tractor and Farm Machinery Operation and Maintenance**

Pre-requisite: Student should have basic knowledge of tractor and farm machinery equipments.

Rationale: A thorough understanding of various tractor makes and models, their functional systems, maintenance procedures, safe operation, and proper hitching techniques is crucial for farmers to maximize efficiency, minimize downtime, ensure safety, and perform essential tasks like tillage, transportation, and implement operation. This knowledge empowers them to make informed decisions about tractor selection, conduct preventative maintenance, troubleshoot problems, achieve optimal field patterns, and extend the lifespan of both tractors and agricultural machinery.

Course Outcomes:

AE 606.1: Students familiarity with different makes and models, safe driving practices, and proper hitching techniques for mounted and trailed implements.

AE 606.2: Students understands the scheduled maintenance procedures, common problems, and how to use appropriate tools for general and specific maintenance tasks.

AE 606.3: Students gain hands-on experience operating tillage tools like moldboard and disc plows, adjusting them for field conditions, and understanding different field patterns.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PCC	22ME471	Tractor and Farm Machinery Operation and Maintenance	0	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: 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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
PCC	22AE678	Tractor and Farm Machinery Operation and Maintenance (Lab)	30	0	0	10	10	50	50	100
		Total								100

AE 606.1: Students familiarity with different makes and models, safe driving practices, and proper hitching techniques for mounted and trailed implements.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	0	10	1	2	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1 Students know the new tractor models, technologies and understand their systems. **SO1.2** Students Learn the essential maintenance points to inspect before starting a tractor for safe and efficient operation. **SO1.3** Student become familiar with the tractor controls understands safe driving practices, and implements essential safety rules. **SO1.4** Students develop practical skills through driving practice, operating and adjusting tillage tools (like moldboard & disc plows)	• Familiarization with different makes and models of agricultural tractors. • Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems. • Study of maintenance points to be checked before starting a tractor. • Familiarization with controls on a tractor. • Safety rules and precautions to be observed while driving a tractor. • Driving practice of tractor. • Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Study of field patterns while operating a tillage implement. • Hitching & De-hitching of mounted and trail type implement to the tractor. • Driving practice with a trail type trolley – forward and in reverse direction. • Introduction to tractor maintenance – precautionary and break-down maintenance.		1. Search a detailed tractor operator's manual (online or physical copy) for a popular model. Study the layout and functions of all controls, including the instrument panel, steering wheel levers, pedals, and auxiliary controls. 2. Research and learn essential tractor safety rules and precautions. This includes proper clothing, pre-operation checks, safe maneuvering techniques, hazard awareness, and emergency procedures.

Assignments:

- Compile a checklist of pre-operation maintenance points for a tractor. This should include engine oil level, coolant level, tire pressure, lights and indicators, and safety features.

Mini Project:

- Prepare a chat of Safety rules and precautions, while driving a tractor and sign or symbols for traffic rules.

AE 606.2: Students understands the scheduled maintenance procedures, common problems, and how to use appropriate tools for general and specific maintenance tasks

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	0	12	2	1	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Students Identify basic tractors malfunction and understand causes. **SO2.2** Students become familiar with general and specialized tractor maintenance tools. **SO2.3** Students will understand maintenance tasks required at different operating hour intervals. **SO2.4** Students learn essential safety practices, engine overhauling basics, fuel efficiency tips, storage preparation, and basic engine knowledge.	• Introduction to trouble shooting in tractors. • Familiarization with tools for general and special maintenance. • Introduction to scheduled maintenance after 10 hours of operation. • Introduction to scheduled maintenance after 100 hours of operation. • Introduction to scheduled maintenance after 300 hours of operation. • Introduction to scheduled maintenance after 600 hours of operation. • Introduction to scheduled maintenance after 900 hours of operation. • Introduction to scheduled maintenance after 1200 hours of operation. • Safety hints of tractors. • Engine Top end overhauling • Fuel saving tips. • Preparing the tractor for storage.	.	1. Research common tractor problems and their symptoms. Explore online resources like tractor troubleshooting guides

Assignments:

i. Enlist and explain the different type of tools use for engine top overhauling.

ii. Write scheduled maintenance charts for 10-hour, 100-hour, and 300-hour, and so on, intervals.

Mini Project:

i. Visit to local tractor dealer of different companies and discussion about common problems in tractor prepare report on it.

AE 606.3: **Students gain hands-on experience operating tillage tools like moldboard and disc plows, adjusting them for field conditions, and understanding different field patterns.**

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	0	10	1	2	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1 Students understanding the care and maintenance procedures required for agricultural machinery during operation and off-season. **SO3.2** Develop proficiency in repair and maintenance techniques for tillage implements, including adjustment of functional parameters and replacement of broken components. **SO3.3** students able to replacement of furrow openers and change of blades of rotavators, ensuring optimal performance. .**SO3.4** Ability to maintain and adjust the cutter bar in a reaper, ensuring efficient harvesting operations.	• Care and maintenance procedure of agricultural machinery during operation and off-season. • Repair and maintenance of implements – adjustment of functional parameters in tillage implements. • Replacement of broken components in tillage implements. • Replacement of furrow openers and change of blades of rotavators. • Maintenance of cutter bar in a reaper. • Adjustments in a thresher for different crops. • Replacement of V-belts on implements • Introduction of Setting of agricultural machinery workshop.		1. Explore online resources, manuals, and case studies to broaden knowledge of best practices in agricultural machinery care and repair. 2. Experiment with hands-on learning by disassembling and reassembling various agricultural implements, observing the functions and interconnections of their components

Assignments:

- Discuss the importance of proper tool selection, storage, and maintenance to ensure smooth workshop operations.

Mini Project:

- Design a maintenance schedule for a workshop setting, outlining procedures for routine checks, repairs, and replacements of key machinery components.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL + LI+SW + SL)
AE606.1: Students familiarity with different makes and models, safe driving practices, and proper hitching techniques for mounted and trailed implements.	0	10	1	2	13
AE 606.2: Students understands the scheduled maintenance procedures, common problems, and how to use appropriate tools for general and [illegible]	0	10	2	1	13
AE606.3: Students will be able to create drawings of agricultural machinery and build their projects as per industry standards.	5	10	2	2	14
Total Hours	**0**	**30**	**5**	**5**	**40**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Student's familiarity with different makes and models, safe driving practices, and proper hitching techniques for mounted and trailed implements.	5	5	20	30
CO-2	Students understand the scheduled maintenance procedures, common problems, and how to use appropriate tools for general and specific maintenance tasks.	5	10	22	37
CO-3	Students will be able to create drawings of agricultural machinery and build their projects as per industry standards.	5	5	23	33
Total		**15**	**20**	**65**	**100**

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

The end of semester assessment for Tractor and Farm Machinery Operation and Maintenance, lab will be held with practical base examination of 100 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to tractor maintenance workshop
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/s	Publisher	Edition & Year
1	Farm Tractor Maintenance & Repair	S.C. Jain & C.R. Mehta	Standard Publishers distributors	Third Edition 2013
2	Practical Agricultural Engineering	R. K. Ghosh	Naya Prokash	1993
3	Tractor Operation and Maintenance (Practical farming)	Neil Southorn	Inkata Press	**1999**
4	You Tube tutorials & video lectures			
5	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

Curriculum Development Team

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Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering
Course Code: 22AE678
Course Title: Tractor and Farm Machinery Operation and Maintenance

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Students familiarity with different makes and models, safe driving practices, and proper hitching techniques for mounted and trailed implements.	3	3	2	2	3	3	-	-	2	1	3	2	3	3	3	2
CO-2 Students understands the scheduled maintenance procedures, common problems, and how to use appropriate tools for general and specific maintenance tasks.	2	2	1	1	3	3	-	-	2	1	-	2	2	2	2	2
CO-3 Students gain hands-on experience operating tillage tools like moldboard and disc plows, adjusting them for field conditions, and understanding different field patterns.	3	3	2	3	3	3	-	-	2	1	2	2	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**	**CO-1** Students familiarity with different makes and models, safe driving practices, and proper hitching techniques for mounted and trailed implements.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**	LI 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10		**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-2** Students understands the scheduled maintenance procedures, common problems, and how to use appropriate tools for general and specific maintenance tasks.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**	LI 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10		
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4**	**CO-3** Students gain hands-on experience operating tillage tools like moldboard and disc plows, adjusting them for field conditions, and understanding different field patterns.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**	LI 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology

Department of Agriculture Engineering & Food Technology

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code: 22AE626

Course Title: **Dairy and Food Engineering**

Pre-requisite: Student should have basic knowledge of physical properties and processing practices of food materials.

Rationale: Dairy and Food Engineering plays a vital role in ensuring a safe, secure, and efficient food supply for a growing global population. It's a field that bridges science, engineering, and consumer needs to create a more sustainable and innovative food system. Dairy and Food Engineering, students will be equipped with the technical knowledge and practical skills to design efficient and safe food processing systems, contribute to new product development, and ensure the quality and safety of our food supply.

Course Outcomes:

AE607.1: Understand the conceptual knowledge about importance and scope of food processing, methods of food processing and gain a thorough understanding of fundamental unit operations in food processing, including homogenization, pasteurization, thermal processing, evaporation, freezing, and drying.

AE 60.2: Acquired the knowledge of the design principles and selection criteria for equipment used in various processes, such as pasteurizers, sterilizers, evaporators, dryers, and packaging machinery.

AE 607.3: Develop the ability to design layouts for dairy and food processing plants, considering factors like product flow, equipment placement, and hygiene.

AE 607.4: Applying engineering principles to solve problems related to food processing. This could involve designing or selecting appropriate equipment, optimizing processes for efficiency, or minimizing losses.

AE 607.5: Apply engineering principles to solve problems encountered during food processing and storage as well as gain an understanding of emerging technologies in the food industry, like bioengineering and advanced packaging etc.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PCC	**22AE626**	**Dairy and Food Engineering**	2	1	1	1	5	3

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) andTutorial(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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	**22AE626**	**Dairy and Food Engineering (Theory)**	0	15	15	0	0	30	50	80
		Dairy and Food Engineering (Practical/Lab)	15	0	0	5	0	20	0	20
		Total								**100**

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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.

AE 607.1: Fundamentals of food Preservation and Processing and applications of Nanotechnology in food processing and Technology

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	2	1	10

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self Learning (SL)**
SO1.1 Apply scientific principles to understand the factors affecting food quality and safety (including spoilage mechanisms). **SO1.2** Analyze and evaluate the effectiveness of different food preservation techniques. **SO1.3**Design and develop food processing systems that minimize waste and ensure product quality and safety. **SO1.4**Apply engineering knowledge to solve problems related to health, safety, and environmental sustainability (food spoilage can impact all three). **SO1.5**Identifying and acquire knowledge the novel processing methods	• Determinatio nof various factors affecting food quality and safety; • Study of different food preservation and processing practices; • Study of the potential effects Nanotechnolo gy in the field of food processing.	**Unit-1.0** **Deterioration in food products and their controls**, Physical and Biological deterioration. Physical, chemical and biological methods of food preservation. **Nanotechnology**: History, fundamental concepts, tools and techniques **Nanomaterials**, applications in food packaging and products, implications, environmental impact of nanomaterials and potential effects of nanotechnology on global economics, Regulation of nanotechnology	1. Scope and importance of Food Process Engineering 2. Various applications ofFood Preservation and Processing

Assignments:

Discuss the different types of losses in different groups of food and milk produce.

Enlist various processing methods.

Mini Project:

Classification and applications of various food processing methods.

AE 607.2: Fundamentals of Dairy Development and Processing

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Develop a basic knowledge of the dairy industry structure, including milk production, processing, and marketing. **SO2.2** Understand the composition of milk and the properties of its major constituents. **SO2.3** Explain the purpose and principles behind various processing techniques used for different dairy products (e.g., butter churning, cheese curd formation). **SO2.4** Describe the basic unit operations involved in dairy processing, such as pasteurization, homogenization, separation, and concentration. **SO2.5**Identify the common quality control measures employed in dairy processing to maintain product quality and consistency.	Chronological Development of Dairy in India; • Study of different unit operations involved in dairy processing.	**Unit-2.0** Dairy development in India, Engineering, thermal and chemical properties of milk and milk products, Process flow charts for different milk product manufacture, Unit operation of various dairy and food processing systems.	Scope and importance of milk processing Effect of white revaluation in India.

Assignments:

Case Study Analysis: Analyze a real-world case study of a challenge faced by the dairy industry (e.g., lactose intolerance, milk contamination). Propose solutions based on your understanding of dairy science and processing principles

Mini Project:

Process Design Project: Design a basic processing flowchart for a specific dairy product, outlining the key unit operations (e.g., filtration, pasteurization, homogenization) and the equipment involved.

AE 607.3: Principles and equipment related to milk processing and Dairy plant design and layout

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 Demonstrate a comprehensive understanding of the principles behind various milk processing unit operations. **SO3.2** Apply engineering principles to select and design equipment for different stages of milk processing. **SO3.3** Development different milk and dairy products. **SO3.4** Develop the ability to design functional and efficient layouts for dairy processing plants. **SO3.5** Integrate principles of sanitation and food safety into the design of dairy processing facilities.	• Study of pasteurizers, • Study of sterilizers, • Study of homogenizers, • Study of cream separators, • Study of butter churns • Study of filtration • Design of food processing plants & preparation of layout;	Unit-3.0 Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation Preparation methods and equipment for manufacture of cheese, *paneer*, butter and ice cream, Filling and packaging of milk and milk products; Dairy plant design and layout, Dairy and Food Processing Plant utilities	1. Evaluate the economic feasibility and sustainability considerations when designing dairy plants including optimizing energy usage, 2. Significance of proper cleaning procedures, minimizing contamination risks, and adhering to regulatory requirements.

Assignments:

- **Product Selection & Market Analysis:** Students choose a target market and define the desired product characteristics.
- **Impact of Processing on Milk Quality:** Research the effects of different processing steps (homogenization, heat treatment) on milk quality parameters like taste, texture, and nutritional value.

Mini Project:

Case Study: Troubleshooting a Processing Issue: Present a case study where a dairy plant encounters a processing issue (e.g., inconsistent product quality, reduced shelf life)

AE 607.4: Principles of operation and equipment for thermal processing of Food Materials.

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 Understand fundamental engineering principles to solve problems related to food production and processing. **SO4.2** Design and develop food processing systems that ensure food safety and quality. **SO4.3** Select and utilize appropriate equipment and technologies for food processing applications. **SO4.4** Analyze and optimize food processing operations for efficiency and sustainability. **SO4.5**Demonstrate a commitment to responsible food production practices that minimize environmental impact.	• Study of different equipments in oil mills and their performance evaluation; • Determination of oil milling efficiency; • Study of different oil milling machines and performance evaluation;	**Unit-4.0** **Principles of operation and equipment for thermal processing**, **Canning,** **Aseptic processing,** **Evaporation** of food products: principle, **Types of evaporators**, multiple effect evaporation, **Steam Economy,** **Vapour recompression:** Thermal &Mechenical	1. **Thermal Processing Method Comparison:** Research and compare two different thermal processing methods (e.g., pasteurization, sterilization, hot-fill canning) 2. Scope and Importance of Canning in Food Processing

Assignments:

- F-Value Calculation and Shelf Life Prediction: Simulate a scenario involving thermal processing of a specific food product. Students calculate the F-value (a measure of lethality) achieved under given processing conditions (time, temperature).
- Thermal Processing Calculations: Develop a spreadsheet or computer program to perform basic calculations related to thermal processing, such as converting between different temperature units or calculating heating times based on desired F-value targets.

Mini Project:

- Various products and by-products during canning.

AE 607.5: Material Handling practices and advancements in Agricultural Processing

Approximate Hours

Item	Cl	LI	SW	SL	Total
Appx. Hrs	5	2	2	1	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Apply engineering knowledge to solve complex problems related to drying and Dehydration of foods. **SO5.2** Design and develop food processing systems that are efficient, sustainable, and meet food safety requirements. **SO5.3** Innovation and developments in new processing technologies to improve product quality, functionality, and shelf life. **SO5.4** Lead and manage food processing operations, ensuring adherence to quality standards and safety regulations. **SO5.5**Select and apply appropriate equipment and technologies for various food processing stages, considering factors like efficiency, product quality, and safety.	• Estimation of refrigeration requirements in dairy & food plant • Design development of Food Process Engineering; Estimation of steam requirements, • Estimation of refrigeration requirements in dairy & food plant	**Unit-5.0** **Drying of liquid and perishable foods**: principles of drying, spray drying, drum drying, freeze drying, **Filtration:** principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, **Non-thermal** and other alternate thermal processing in Food processing	1. How to minimize nutrient losses and maintain product quality during processing of fruits and vegetables. 2. Various Novel thermal processing methods in Food Processing..

Assignments:

Discuss the commercial dryers and their classifications used in Food Industry.

Explore potential equipment malfunctions and propose troubleshooting procedures to ensure smooth operation and product safety. Draw flowchart for various milling process

Mini Project:

- **Sustainable Plant Design Proposal:** Research and propose sustainable design features that can be incorporated into a dairy processing plant. This could include energy-efficient equipment, water conservation strategies, or waste minimization plans.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl + SW + Sl)
AE 607.1: Fundamentals of food Preservation and Processing and applications of Nanotechnology in food processing and Technology	5	2	2	9
AE 607.2: Fundamentals of Dairy Development and Processing	5	2	2	9
AE 607.3: Principles and equipment related to milk processing and Dairy plant design and layout	5	2	2	9
AE 607.4: Principles of operation and equipment for thermal processing of Food Materials.	5	2	2	9
AE 607.5: Material Handling practices and advancements in Agricultural Processing	5	2	2	1
TotalHours	**25**	**10**	**10**	**45**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	**U**	**A**	
CO-1	Understand the conceptual knowledge about importance and scope of food processing	04	05	01	10
CO-2	Acquired the knowledge of the design principles and selection criteria for equipment used in various processes	04	04	02	10
CO-3	Develop the ability to design layouts for dairy and food processing plants	05	04	03	11
CO-4	Applying engineering principles to solve problems related to food processing. This could involve designing or selecting appropriate equipment	04	05	03	12
CO-5	Apply engineering principles to solve problems encountered during food processing and storage as well as gain an understanding of emerging technologies in the food industry	03	02	02	07
Total		**20**	**20**	**10**	**50**

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

The end of semester assessment for Dairy and Food 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to milk processing plants
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/s	Publisher	Edition&Year
1	Dairy Plant Engineering and Management	Ahmed, T	4th Ed. Kitab Mahal	1997
2	Unit operations of Agricultural Processing	Sahay, K.M. and Singh, K.K.	Vikas Publishing house Pvt. Ltd. New Delhi	1994
3	Fundamentals of Food Process Engineering	Toledo, R. T.	CBS Publisher	2014
4	Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi			
5	McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.			
6	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
7	Lecturenoteprovidedby Dept.ofAgril. Engineering,AKSUniversity,Satna.			

Curriculum Development Team

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Cos,PosandPSOsMapping

Course Title: B.Tech. Agricultural Engineering

Course Code : 22HO601

Course Title: Dairy and Food Engineering

CourseOutcomes	ProgramOutcomes												ProgramSpecificOutcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Understand the conceptual knowledge about importance and scope of food processing	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO-2 Acquired the knowledge of the design principles and selection criteria for equipment used in various processes	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO-3 Develop the ability to design layouts for dairy and food processing plants	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Applying engineering principles to solve problems related to food processing. This could involve designing or selecting appropriate equipment	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 Apply engineering principles to solve problems encountered during food processing and storage as well as gain an understanding of emerging technologies in the food industry	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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** Understand the conceptual knowledge about importance and scope of food processing	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	As Mentioned along with the concern units	AE 601.1: Fundamentals of food Preservation & Processing & applications of Nanotechnology	As Mentioned along with the concern units
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-2** Acquired the knowledge of the design principles and selection criteria for equipment used in various processes	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 602.1: Fundamentals of Dairy Development and Processing	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-3** Develop the ability to design layouts for dairy and food processing plants	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 603.1: Principles and equipment related to milk processing and Dairy plant design and layout	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-4** Applying engineering principles to solve problems related to food processing. This could involve designing or selecting appropriate equipment	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 604.1: Principles of operation and equipment for thermal processing of Food Materials.	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 PSO 1,2, 3, 4, 5	**CO-5** Apply engineering principles to solve problems encountered during food processing and storage as well as gain an understanding of emerging technologies in the food industry	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		AE 605.1: Material Handling practices and advancements in Agricultural Processing	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VI

Course Code:	22AE627
Course Title :	**Bio-Energy Systems: Design and Applications**
Pre- requisite:	Student should have basic knowledge of chemical reactions, properties of different materials (fuels, biomass), and basic principles of thermodynamics.
Rationale:	The students studying agricultural engineering should possess foundational understanding about role of bio-energy and its application. Compared to fossil fuels, bio-energy systems can potentially offer lower greenhouse gas emissions, especially if designed and managed sustainably. Bio-energy systems can utilize organic waste materials, reducing dependence on landfills and promoting waste-to-energy solutions. This encompasses fermentation processes of biomass, biomass production and biomass preparation techniques for harnessing also to make the biodiesel production process.

Course Outcomes:

AE 608.1: Students understand the fermentation process for biomass conversion into useful energy and land fill gas technology.

AE 608.2: Students acquire the knowledge about wasteland utilization for biomass production (energy plantation) and it's harvesting process.

AE 608.3: Students know the biomass preparation technique for harnessing and thermo-chemical degradation of biomass.

AE 608.4: Students understand about gasifier technique to produce producer gas for generating shaft power.

AE 609.5: Students gain the knowledge about Trans-esterification for biodiesel production, bio-hydrogen production routes and green house gas mitigation.

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 (PCC)	22AE627	Bio-Energy Systems: Design and Applications	3	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	**22AE627**	**Bio-Energy Systems: Design and Applications (Theory)**	0	15	15	0	0	30	50	80
		Bio-Energy Systems: Design and Applications (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 608.1: Students understand the fermentation process for biomass conversion into useful energy and land fill gas technology.

Approximate Hours

Item	AppX Hrs
Cl	5
LI	2
SW	2
SL	2
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Students understand the fermentation processes and its requirements **SO1.2** Analyze how fermentation drives various industries **SO1.3** Understand the role of heat transfer in maintaining optimal conditions within these systems. **SO1.4** Evaluate the technology and potential of landfill gas as a renewable energy source **SO1.5** Gain a comprehensive understanding of fermentation's role in a sustainable bio-based economy.	1.1 To Study about anaerobic fermentation system for industrial application	**Unit-1.0 Fermentation and landfill gas Technology** 1.1 Fermentation process and its general requirements 1.2 overview of aerobic and anaerobic fermentation processes 1.3 Industrial application of fermentation 1.4 Heat transfer processes in anaerobic digestion systems 1.5 land fill gas technology and potential	1. Describe the methods of land fill gas well extraction 2. Enlist the types of fermentation and explain it.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Describe different phases of growth curve of bacterial culture with suitable curve

ii. Differentiate between aerobic and anaerobic fermentation.

b. Mini Project:

i. Developed a model of fermenter.

c. Other Activities (Specify):

i. List out the nutrient requirement for microbial activity

AE 608.2: Students acquire the knowledge about wasteland utilization for biomass production (energy plantation) and it's harvesting process.

Approximate Hours

Item	App X Hrs
Cl	5
LI	2
SW	2
SL	1
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1 Students learn about Learned about the potential of using degraded wastelands for establishing energy plantations. **SO2.2** To understand the importance of classifying Wastelands based. **SO2.3** Students learned about effective transplanting techniques to ensure seedling survival and growth. **SO2.4** Students know about different methods for harvesting biomass for energy production. **SO2.5** Ability to re grow shoots after harvesting, allowing for multiple biomass harvests from a single plantation over time.	2.1 Integral bio energy system for industrial application	**Unit-2 Biomass Production & harvesting** 2.1 Introduction to wastelands. 2.2 classification of wasteland and their use through energy plantation 2.3 selection of species for energy plantation 2.4 Methods of field preparation and transplanting for biomass. 2.5 Harvesting of biomass and coppicing characteristics	1. Classified the wasteland and collect the data of waste land in India.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

I. Prepare the list of different species of petro plants for energy plantation specially Satna district

II. Prepare at least 20 objectives question related to wastelands for energy plantation.

b. Mini Project:

i. Collect data of wasteland in Satna district

c. Other Activities (Specify):

Find and enlist the species of petro plant which is already grown in Satna district

AE 608.3: Students know the biomass preparation technique for harnessing and thermo-chemical degradation of biomass

Approximate Hours

Item	AppX Hrs
Cl	4
LI	4
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Student understand about densification methods of biomass for pelletization, & briquetting. **SO3.2** Gained knowledge about thermo-chemical conversion processes of biomass **SO3.3** Explored the historical development and evolution of small-scale gasifier systems for generating power **SO3.4** Learned about the key chemical reactions involved in gasification	3.1 Study of biomass densification technique (briquetting, pelletization, and cubing) 3.2 Study of gasification for industrial process heat	**Unit-3 : Biomass preparation** 3.1 Biomass preparation techniques for harnessing. 3.2 Thermo-chemical degradation of biomass 3.3 History of small gas producer engine system 3.4 Chemistry of gasification.	1. Search and Study about different type of briquetting machine

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the different methods of thermo- chemical conversion of biomass.
ii. Write the history of small scale gasifier system for generating the power.

b. Mini project

i. Developed a model of dendro thermal power plant.

c. Other Activities (Specify):

I. Prepare a chart for Chemistry of gasification.

AE 608.4: Students understand about gasifier technique to produce producer gas for generating shaft power.

Approximate Hours

Item	AppX Hrs
Cl	5
LI	4
SW	2
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Students understand the basic operating principles of gasifier. **SO4.2** Understanding the gasifier fuel properties. **SO4.3** Students know the methods remove the impurities of fuels. **SO4.4** Students know the application of producer gas (shaft power) **SO4.**5 Student evaluate the economics as compare to fossil fuels	**4**.1 Study of bio energy efficiency in industry and commercial buildings 4.2 Study and demonstration of energy efficiency in building	**Unit-4: Producer gas & its application** 4.1 Operating principle of gasifier & its types 4.2 Gasifier fuels & its properties 4.3 Conditioning of producer gas 4.4 shaft power generation 4.5 thermal application and economics	i. Search and learn different kind of fuel properties for gasifier.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Classified and explain the different type of gasifier

ii. Explain the different methods of condition of producer gas.

b. Mini Project:

i. Prepare a chart for different type of gasifier

c. Other Activities (Specify):

i. Identify the industrial application of gasifier & economics

AE 608.5: Students gain the knowledge about Trans-esterification for biodiesel production, bio-hydrogen production routes and green house gas mitigation.

Item	AppX Hrs
Cl	4
LI	6
SW	2
SL	2
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO 5.1 Understand the process of trans-esterification and its role in biodiesel production. **SO 5.2** Gain insights into the advantages and potential challenges associated with this method. **SO 5.3** Evaluate the environmental benefits of bio-energy, particularly its potential to mitigate greenhouse gas emissions. **SO 5.4** Critically assess potential drawbacks of bio-energy production, such as land-use change concerns.	5.1 Study of biodiesel production unit 5.2 Study of modern greenhouse technologies 5.3 Study of Brayton, Striling and Rankine cycles	**Unit 5: Biodiesel & Bio hydrogen production** 5.1 Trans-esterification for biodiesel production. 5.2 bio-hydrogen production routes 5.3 Environmental aspect of bio-energy 5.4 assessment of greenhouse gas mitigation potential	i. Research and Compare the trans-esterification process using different catalysts (acid vs. base). ii. compare the dark and photo fermentation of bio hydrogen production.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the chemistry of vegetable oil biodiesel, and several ways to make it;

ii.Evaluate the potential environmental and economic benefits of bio-energy.

b. Mini Project:

i. Design a small-scale model (using non-hazardous materials) demonstrating a chosen bio-hydrogen production route (e.g., a simple photo fermentation setup).

c. Other Activities (Specify):

Draw flow chart of biodiesel production process.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+ SW+SL)
AE 608.1: Students understand the fermentation process for biomass conversion into useful energy and land fill gas technology.	5	2	2	2	11
AE 608.2: Students acquire the knowledge about wasteland utilization for biomass production (energy plantation) and it's harvesting process.	5	2	2	1	10
AE 608.3: Students know the biomass preparation technique for harnessing and thermo-chemical degradation of biomass	4	4	2	1	11
AE 608.4: Students understand about gasifier technique to produce producer gas for generating shaft power.	5	4	2	1	12
AE 608.5: Students gain the knowledge about Trans-esterification for biodiesel production, bio-hydrogen production routes and green house gas mitigation..	4	6	2	2	14
Total Hours	23	18	10	7	68

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Fermentation and landfill gas	02	02	01	05
CO-2	Biomass Production & harvesting	03	05	02	10
CO-3	Biomass preparation	03	06	05	15
CO-4	Producer gas & its application	02	07	06	15
CO-5	Biodiesel & Bio hydrogen production	01	03	01	05
Total		12	23	15	50

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

The end of semester assessment for Bio-Energy Systems: Design and Applications 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a) **Books** :

S. No.	Title	Author	Publisher	Edition &Year
1	Handbook of Bioenergy	Sandra D. Eksioglu Steffen Rebennack Panos M. Pardalos	Springer	First Edition, 2015
2	Biomass for Bioenergy and Biomaterials	Nidhi Adlakha, Rakesh Bhatnagar Syed Shams Yazdani	CRC Press Taylor and Francis group	2021
3	Biofuel from Microbes and Plants	Nitish Kumar	CRC Press Taylor and Francis group	First Edition, 2021
4	Handbook On Biofuel, Ethanol And Bioenergy Based Products,	P. K. Chattopadhyay	Asia Pacific Business Press Inc.	First Edition
5	Lecture note provided by Dept. of Agricultural engineering , AKS University, Satna .			

Curriculum Development Team

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Cos, POs and PSOs Mapping

Course Title: B. Tech. (Agricultural Engineering)
Course Code: 22AE627
Course Title: Bio-Energy Systems: Design and Applications

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Students understand the fermentation process for biomass conversion into useful energy and land fill gas technology.	1	1	1	-	2	2	3	1	2	1	2	3	2	3	3	1
CO 2 : Students acquire the knowledge about wasteland utilization for biomass production (energy plantation) and it's harvesting process.	1	1	2	-	2	2	3	1	3	1	3	3	2	2	2	1
CO3: Students know the biomass preparation technique for harnessing and thermo-chemical degradation of biomass	2	2	2	1	2	2	3	1	2	1	2	2	2	1	2	2
CO4: Students understand about gasifier technique to produce producer gas for generating shaft power.	3	2	3	2	3	2	3	1	2	1	3	1	3	3	3	2
CO 5: Students gain the knowledge about Trans-esterification for biodiesel production, bio-hydrogen production routes and green house gas mitigation.	2	3	3	2	3	3	3	1	3	1	2	2	3	3	2	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	CO-1: Students understand the fermentation process for biomass conversion into useful energy and land fill gas technology.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI 1.1	Unit-1.0 Fermentation and landfill gas 1.1,1.2,1.3,1.4,1.5	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-2: Students acquire the knowledge about wasteland utilization for biomass production (energy plantation) and it's harvesting process.	SO2.1 SO2.2	LI 2.1	Unit-2 Biomass Production & harvesting 2.1, 2.2, 2.3, 2.4, 2.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-3: Students know the biomass preparation technique for harnessing and thermo-chemical degradation of biomass	SO3.1 SO3.2	LI 3.1 LI 3.2	Unit-3 : Biomass preparation 3.1, 3.2,3.3,3.4	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 4: Students understand about gasifier technique to produce producer gas for generating shaft power.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI 4.1 LI 4.2	Unit-4 : Producer gas & its application 4.1, 4.2, 4.3, 4.4, 4.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 5: Students gain the knowledge about Trans-esterification for biodiesel production, bio-hydrogen production routes and green house gas mitigation.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI 5.1 LI 5.2 LI 5.3	Unit 5: Biodiesel & Bio hydrogen production 5.1,5.2,5.3,5.4	

AKS UNIVERSITY, SATNA

Faculty of Agriculture Science and Technology
Department of Agricultural Engineering

B.Tech. (Agricultural Engineering) Programme

Student READY

(Rural and Entrepreneurship Awareness Development Yojana)

The world is currently witnessing huge technological, socio-economic and political transformations, necessitating nations to change their priorities, investments, and institutions, and to launch new initiatives accordingly. In this context, the Fifth Deans' Committee of ICAR has recommended the **Student READY** (Rural and Entrepreneurship Awareness Development Yojana), as a new initiatives for aligning Agricultural Engineering curricula with the current national needs and initiatives and with international trends and the department follows the said recommendations as per the given guidelines.

The Student **READY** (Rural Entrepreneurship Awareness Development Yojana) program aims to provide rural entrepreneurship awareness, and practical experience in a real-life situation in rural agriculture, and create awareness to undergraduate students about practical agriculture and allied sciences.

The program will help in building confidence, skills, and acquiring Indigenous Technical Knowledge (ITK) of the locality and thereby preparing the pass-out for self-employment. It also aims to provide opportunities to acquire hands-on experience and entrepreneurial skills. To reorient graduates of agriculture and allied subjects for ensuring and assuring employability and developing entrepreneurs for emerging knowledge-intensive agriculture, this program as an essential prerequisite for the award of degree to ensure hands-on experience and practical training.

As per the guidelines of the Fifth Deans committee of ICAR, the course curricula have been restructured to develop much-needed skills and entrepreneurial mindset among the graduates to take up self-employment, contribute to the enhanced rural livelihood and food security, sustainability of agriculture, and be propeller for agricultural transformation.

Agriculture Engineering Student READY program of the Agricultural Engineering is proposed to have the following components:

1. Summer break after IV semester - Student READY **Skill Development Training -I** for five weeks in the summer break after IV semester with a credit load of 0+5 credit hours.
2. Summer break after VI semester - Student READY **Skill Development Training - II** for five weeks in the summer break after VI semester with a credit load of 0+5 credit hours.
3. Semester VII - **Industrial attachment/Internship** of 10 weeks with a credit load of 0+10 credit hours.
4. Semester VII - **On campus Experiential Learning Program** of 12 weeks with a credit load of 0+10 credit hours.
5. Semester VIII - **Project Planning and Report Writing** of 12 weeks with a weightage of 0+10 credit hours.

Skill Development Training

Skill development is the process of improving specific skills to be more efficient and effective when students perform a task. In the workplace, the students will find three main types of skill development: **Upskilling**: Improving r skills in current role, **Cross-skilling**: Learn new skills for current role and **Reskilling:** Learning new skills to move in a new role

Skill- Ability to do something that comes from training, experience and practice etc. Skills development is the process of –

(1) Identifying your skill gaps,

(2) Developing and honing these skills

The objectives of the Skill Development Trainings are to:

- Create opportunities for all to acquire skills throughout life.
- Promote commitment by all stakeholders to own skill development initiatives.
- Develop a high-quality skilled workforce/entrepreneur relevant to current and emerging employment market needs.
- Enable the establishment of flexible delivery mechanisms that respond to the characteristics of a wide range of needs of stakeholders.
- Enable effective coordination between different ministries, the centre, the states and public & private providers

Major areas for skill training include: Agri- warehousing, Organic Farming, value-addition, Biomass and Bio fuel production, micro-irrigation, soil testing & analysis, fertilizers & micro-nutrients application, etc. Focus of skill training on farm mechanization, operation, maintenance, management and repair of farm machinery equipments.

Skill development is required for farm level producers, input producers and distributors, service providers, and post-harvest operations and marketing of farm produce, whereas skills for electronic marketing, value/supply chain management, advisory and consultancy services etc

In Plant Training (IPT)/ Industrial Attachment

Technology and globalization are ushering an era of unprecedented change. The need and pressure for change and innovation is immense. To enrich the practical knowledge of the students, in-plant training is mandatory. In this training, students will have to study a problem in industrial perspective and submit the reports to the university. Such in-plant trainings will provide an industrial exposure to the students as well as to develop their career in the high tech industrial requirements. In-Plant training is meant to correlate theory and actual practices in the industries with the following objectives

- To expose the students to Industrial environment, this cannot be simulated in the university.
- To familiarize the students with various Materials, Machines, Processes, Products and their applications along with relevant aspects of shop management.
- To make the students understand the psychology of the workers, and approach to problems along with the practices followed at factory
- To make the students understand the scope, functions and job responsibility-ties in various departments of an organization.
- Exposure to various aspects of entrepreneurship during the program period.

On campus Experiential Learning Program

Experiential Learning (EL) with business mode helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their own enterprise and turn job creators instead of job seekers. This is a step forward for “Earn while Learn” concept. Experiential Learning is an important module for high quality professional competence and practical work experience in real life situation to Graduates. The module with entrepreneurial orientation of production and production to consumption pattern is expected to facilitate producing Job Providers rather than Job Seekers. The EL provides the students an excellent opportunity to develop analytical and entrepreneurial skills, and knowledge through meaningful hands on experience, confidence in their ability to design and execute project work. The main objectives of Experiential Learning Program are:

- To promote professional skills and knowledge through meaningful hands on experience.
- To build confidence and to work in project mode.
- To acquire enterprise management capabilities.

Project Planning and Report Writing

There is number of students interested in higher education and study abroad. Keeping in view their future requirement a component of Student Project/Dissertation is placed to understand and identify problems of his/ her interest and field, experimental set up, taking observation and writing and documentation in the form of thesis/project report. Project work provides several opportunities to students to learn various aspects that cannot be taught in a class room or laboratory. In order to provide such opportunities to the graduates of agricultural Engineering, Students Project is proposed as one of the components of the Student READY. It may be adopted based on the interest of student and expertise and facilities available with the University.

A Good Project should have: **i)** Originality, Innovation and creativity and should commensurate with understanding the problem and finding solution. **ii)** Relevance of the project to the community and impact of the project on society. **iii)** Proper understanding of the subject, quality and quantity of the work and efforts to validate the data collected. The Students Project is proposed with the following objectives:

- To impart analytical skills and capability to work independently.
- To conceptualize, design and implement the proposed work plan.
- Learn to work as a team- sharing work amongst a group, and learn leadership
- Learn to solve a problem through all its stages by understanding and applying project management skills.
- Learn to do various implementations, fabrication, testing and trouble shooting.
- Learn communication report writing skills.

Course Code: **22AE570, 22AE774, 22AE773, 22AE772, 22AE771 and 22AE871**

Course Title: **STUDENT READY**

Pre-requisite: Student should have basic knowledge of agricultural Engineering and practices of agricultural technology.

Rationale: Student READY seeks to create a new generation of agricultural entrepreneurs who are equipped with the skills and knowledge to drive positive change in rural areas.

Course Outcomes:

The Student READY (Rural Entrepreneurship Awareness Development Yojana) program aims to equip undergraduate students in agricultural and allied sciences with the skills and knowledge necessary to pursue careers in rural entrepreneurship. Here are the main course outcomes of STUDENT READY:

1. **Develop entrepreneurial skills and knowledge:** Students will gain a strong understanding of the entrepreneurial process, from ideation and business planning to marketing and financial management.
2. **Gain practical experience:** Through hands-on training and internships, students will develop the practical skills needed to start and run their own businesses.
3. **Build confidence and self-reliance:** The program will help students develop the confidence and self-reliance necessary to succeed as entrepreneurs.
4. **Increase awareness of rural issues and opportunities:** Students will gain a deeper understanding of the challenges and opportunities facing rural communities.
5. **Promote self-employment:** The program aims to equip students with the skills and knowledge they need to become successful entrepreneurs and create jobs for themselves and others.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
PRC/IPT	**22AE570**	**IN-PLANT TRAINING - I**	0	6	0	4	10	5
PRC/IPT	**22AE774**	**EDUCATIONAL TOUR**	0	2	0	2	4	2
PRC/IPT	**22AE773**	**SKILL DEVELOPMENT TRAINING-II**	0	6	0	4	10	5
PRC/IPT	**22AE772**	**EXPERIENTIAL LEARNING ON CAMPUS**	0	12	0	8	20	10
PRC/IPT	**22AE771**	**INDUSTRIAL ATTACHMENT/ INTERNSHIP**	0	12	0	8	20	10
PRC/IPT	**22AE871**	**PROJECT PLANNING AND REPORT WRITING**	0	12	0	8	20	10

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

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment	Total Marks
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
PRC/ IPT	**22AE570**	**IN-PLANT TRAINING - I**	-	-	-	-	-	-	100	100
PRC/ IPT	**22AE774**	**EDUCATIONAL TOUR**	-	-	-	-	-	-	100	100
PRC/ IPT	**22AE773**	**SKILL DEVELOPMENT TRAINING-II**	-	-	-	-	-	-	100	100
PRC/ IPT	**22AE772**	**EXPERIENTIAL LEARNING ON CAMPUS**	-	-	-	-	-	-	100	100
PRC/ IPT	**22AE771**	**INDUSTRIAL ATTACHMENT/ INTERNSHIP**	-	-	-	-	-	-	100	100
PRC/ IPT	**22AE871**	**PROJECT PLANNING AND REPORT WRITING**	-	-	-	-	-	-	100	100
		Total								**600**

Cos, Pos and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering Course Code: 22AE570, 22AE774, 22AE773, 22AE772, 22AE771 and 22AE871

Course Title: STUDENT READY

i. In-plant training - i
ii. Skill development training-ii
iii. Educational tour
iv. Experiential learning on campus
v. Industrial attachment/ internship
vi. Project planning and report writing

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Develop entrepreneurial skills and knowledge	2	1	2	2	3	2	3	2	2	3	3	2	2	3	3	3
CO-2 Gain practical experience	2	3	2	2	2	2	3	2	1	3	2	2	2	2	2	3
CO-3 Build confidence and self-reliance	2	2	1	3	2	2	2	2	1	3	1	2	3	2	2	3
CO-4 Increase awareness of rural issues and opportunities	3	2	2	2	3	2	3	2	2	3	2	3	3	3	3	3
CO-5 Promote self-employment	2	3	2	1	1	3	3	3	1	3	2	2	3	3	1	3

Legend:1–Low,2–Medium,3– High

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme
Semester-VIII

Course Code:	29AE873-B
Course Title :	Tractor Design and Testing
Pre- requisite:	Student should have basic knowledge of tractor and automotive engine their components and basic design criteria.
Rationale	The students studying agricultural engineering should possess foundational of the comprehensive study and implementation of tractor design and development encompasses multiple critical components essential for optimal tractor performance and safety. Additionally, the design of mechanical power transmission components like single and multi-disc clutches, as well as cone clutches, along with the selection of rolling friction and anti-friction bearings. Ergonomic considerations in the design of seats and controls prioritize operator comfort and productivity. Lastly, the implementation of a rigorous tractor testing procedure, including engine testing per BIS code, drawbar performance assessment, PTO testing, measurement of tractor power output, evaluation of turning space, turning radius, brake performance, hydraulic pump efficiency, air cleaner effectiveness, and noise levels, ensures compliance with standards and verifies operational capabilities across various parameters, ultimately enhancing reliability and functionality in agricultural settings.

Course Outcomes:

AE 803.1: Students able to apply engineering principles to design balanced, stable agricultural tractor and theories behind traction, allowing you to design for optimal power transfer to the ground.

AE 803.2: Students analyze and design various clutch mechanisms or minimizing friction losses by understanding rolling friction and anti-friction bearings and design steering mechanism.

AE 803.3: Students understand of agricultural tractor engines, focusing on the unique design considerations for components like cylinders, pistons, and crankshafts and designing the operator's seat and controls.

AE 803.4: Students gain hands-on knowledge in evaluating tractor performance as per BIS code and standards.

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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)	
Professional elective courses (PEC)	29AE873-B	Tractor Design and Testing	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:

Theory & Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PEC	29AE873-B	**Tractor Design and Testing (Theory)**	0	15	15	0	0	30	50	80
		Tractor Design and Testing (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE 803.1: Students able to apply engineering principles to design balanced, stable agricultural tractor and theories behind traction, allowing you to design for optimal power transfer to the ground.

Approximate Hours

Item	AppX Hrs
CL	6
LI	2
SW	2
SL	2
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the design consideration of tractor **SO1.2** Student gain the knowledge of parameters for balance design of tractor **SO1.3** Evaluate the developed traction power. **SO1.4** Student know basic design concept of hydraulic system .	1.1 Design and selection of hydraulic pump	**Unit-1.0 Agricultural Tractor Design Fundamentals** 1.1 Procedure for design and development of agricultural tractor 1.2 Study of parameters for balanced design of tractor for stability 1.3 Weight distribution Phenomenon 1.4 Traction theory 1.5 hydraulic lift 1.6 hitch system design	1. Research different types of agricultural tractors and their applications . 2. Review basic engineering mechanics principles

SW-1 Suggested Sessional Work (SW):

a. Assignments:

I. Draw a free body diagram of tractor and describe the weight transfer phenomenon

II. Solve the numerical for hydraulic system of tractor

b. Mini Project:

i. Develop a presentation on the evolution of agricultural tractors.

c. Other Activities (Specify):

i. Create a basic 2D & 3D model of a tractor chassis in software.

AE 101.2: Students analyze and design various clutch mechanisms or minimizing friction losses by understanding rolling friction and anti-friction bearings and design steering mechanism.

Approximate Hours

Item	AppX Hrs
CL	5
LI	4
SW	2
SL	2
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO2.1 Analyze the function of clutches in a tractor's power transmission system for design. **SO2.2** Students understand the role of bearings in power transmission and select appropriate types. **SO2.3** Student gain the knowledge of Ackerman steering system and design. **SO2.4** Understand the principles behind hydraulic steering systems and design a system for tractor	2.1 Design problem of tractor clutch – (Single/ Multiple disc clutch). 2.2 Design of gear box(synchromesh/constant mesh), variable speed constant mesh drive	**Unit-2 Design of mechanical power transmission** 2.1 Design of clutch (single &multi disc 2.2 Design of cone clutches 2.3 Rolling friction and anti-friction bearings 2.4 Design of Ackerman Steering 2.5 Design of hydraulic steering.	1. Study the working mechanisms of various clutch types. 2. Investigate the components and functionality of hydraulic steering systems.

SW-2 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Solve the numerical on clutches (single multi disc and cone clutches)
   ii. Compare the Ackerman steering mechanism and Davis steering mechanism

b. **Mini Project:**
   i. Design a comparison chart analyzing different clutch options for a specific tractor application.

c. **Other Activities (Specify):**
   Develop a simulation model of a tractor steering system using software

AE 803.3: Students understand of agricultural tractor engines, focusing on the unique design considerations for components like cylinders, pistons, and crankshafts and designing the operator's seat and controls.

Approximate Hours

Item	AppX Hrs
CL	8
LI	4
SW	2
SL	2
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (S)
SO3.1 Explore design features of key engine components like cylinders (number, arrangement), pistons (materials, coatings), piston pins (strength, wear resistance), and crankshafts (material strength, bearing design). **SO3.2** Explore the design considerations for the tractor seat (adjustability, suspension, vibration dampening) for long working hours. **SO3.3** Analyze the placement and design of controls (steering wheel, pedals, levers) for intuitive operation and minimizing operator fatigue.	3.1 Problem on design of governor system 3.2 Selection of tractor tires	**Unit-3 : Design of Engine components** 3.1 Design of cylinder 3.2 design of cylinder head 3.3 Design of piston 3.4 Design of piston ring 3.5 Design of piston pin 3.6Desin of Crank shaft 3.7Seat design of tractor as per ergonomics 3.8 Design of tractor controls.	i. Review technical specifications tractor manufacturers like John Deere, Mahindra & Mahindra, Sonalika and Kubota etc. ii. Documentaries about modern agriculture or the history of tractors might offer insights into the evolution of engine design and operator interface features to meet changing needs.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

i. Design a layout for the tractor control panel (steering wheel, pedals, and levers) considering ease of use, operator comfort.

ii. Collect the anthropometry data of 100 peoples and design the tractor seat.

b. Mini Project:

i. Design a crankshaft and prepare a 2D drawing in AutoCAD software.

c. Other Activities (Specify):

i. Visit the farmer field on your area and collect the data of tractor power and matching implements.

AE 803.4: Students gain hands-on knowledge in evaluating tractor performance as per BIS code and standards.

Approximate Hours

Item	AppX Hrs
CL	7
LI	8
SW	2
SL	2
Total	18

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (S)**
SO4.1 Understands the specific BIS codes and procedures for tractor testing engine performance. **SO4.2** understanding of the principles behind drawbar testing and its importance in assessing a tractor's pulls capacity. **SO4.3** Students learn PTO testing measures the power available at the PTO shaft for powering implements. **SO4.4** Students understand the concepts of turning space, turning radius, and their significance for tractor maneuverability in tight spaces. **SO4.5** students will gain understanding of the importance of brake testing for evaluating a tractor's stopping power and safety.	1.1 To study about Drawbar performance. 1.2 To study about PTO performance test 1.3 To determining the turning space, turning radius and brake test 1.4 To study about hydraulic pump performance test and air cleaner and noise measurement test.	**Unit-4: Tractor Testing Procedure** 4.1 Enlist and remember the test BIS codes for tractor testing 4.2 Drawbar performance test 4.3 PTO performance test 4.4 Determine the turning space & turning radius 4.5 Brake test 4.5 Hydraulic pump performance test 4.6 Air cleaner testing 4.7 noise measurement test.	i. Research common tractor problems related to specific tests (e.g., low engine power, weak hydraulic performance). ii. Develop a case study where you analyze the symptoms and utilize your knowledge of BIS testing procedures to diagnose the potential cause of the problem.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Read and analyze the BIS code, identifying the key parameters measured, test procedures, and data recording methods.

b. Mini Project:

i. Collect the data of test report and draw the performance curves or chart.

c. Other Activities (Specify):

i. Prepare a presentation on different test procedure and present in class room.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+ SL)
AE803.1: Students able to apply engineering principles to design balanced, stable agricultural tractor and theories behind traction, allowing you to design for optimal power transfer to the ground	6	2	2	2	12
AE803.2: Students analyze and design various clutch mechanisms or minimizing friction losses by understanding rolling friction and anti-friction bearings and design steering mechanism.	5	4	2	2	13
AE803.3: Students understand of agricultural tractor engines, focusing on the unique design considerations for components like cylinders, pistons, and crankshafts and designing the operator's seat and controls.	8	4	2	2	16
AE803.4: Students gain hands-on knowledge in evaluating tractor performance as per BIS code and standards.	7	8	2	2	19
Total Hours	**26**	**18**	**8**	**8**	**60**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Agricultural Tractor Design Fundamentals	02	05	03	10
CO-2	Design of mechanical power transmission	02	05	03	10
CO-3	Design of Engine components	03	07	05	15
CO-4	Tractor Testing Procedure	03	07	05	15
Total		10	24	16	50

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

The end of semester assessment for Tractor Design and Testing 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to tractor testing Institute (Bhudni, Bhopla , M.P.)
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Design Of Agriculture Tractor	By D.N. Sharma	VISIONIAS	Second Edition 2016
2	Fundamentals of Tractor Design	Karl Theodor Renius	Springer Nature Switzerland AG	First Edition 2020
3.	Tractor Design and Testing	Dr. Manjit Singh, Dr. L. N. Shukla	Free PDF , Online	
3.	Lecture note provided by Dept. of Cement Technology, AKS University, Satna .			

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Cos, POs and PSOs Mapping

Course Title: B. Tech. Agricultural Engineering
Course Code: 29AE873-B
Course Title: Tractor Design and Testing

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO1: Students able to apply engineering principles to design balanced, stable agricultural tractor and theories behind traction, allowing you to design for optimal power transfer to the ground	3	3	3	2	2	2	2	2	2	1	3	2	3	3	3	2
CO 2 : Students analyze and design various clutch mechanisms or minimizing friction losses by understanding rolling friction and anti-friction bearings and design steering mechanism.	3	3	3	1	2	3	1	1	1	1	2	2	2	2	3	2
CO3: Students understand of agricultural tractor engines, focusing on the unique design considerations for components like cylinders, pistons, and crankshafts and designing the operator's seat and controls.	3	3	3	1	2	3	2	2	1	1	1	2	2	3	2	2
CO4: Students gain hands-on knowledge in evaluating tractor performance as per BIS code and standards.	3	3	3	2	2	2	1	1	2	1	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	CO-1: Students able to apply engineering principles to design balanced, stable agricultural tractor and theories behind traction, allowing you to design for optimal power transfer to the ground	SO1.1 SO1.2 SO1.3 SO1.4	LI 1.1	Unit-1.0 **Agricultural Tractor Design Fundamentals** 1.1,1.2,1.3,1.4,1.5,1.6	**As Mentioned along with the concern units**
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-2: Students analyze and design various clutch mechanisms or minimizing friction losses by understanding rolling friction and anti-friction bearings and design steering mechanism.	SO2.1 SO2.2 SO2.3 SO2.4	LI 2.1 LI 2.2	Unit-2 **Design of mechanical power transmission** 2.1, 2.2, 2.3, 2.4, 2.5	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO-3: Students understand of agricultural tractor engines, focusing on the unique design considerations for components like cylinders, pistons, and crankshafts and designing the operator's seat and controls.	SO3.1 SO3.2 SO3.3	LI 3.1 LI 3.2	Unit-3 : **Design of Engine components** 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 4: Students gain hands-on knowledge in evaluating tractor performance as per BIS code and standards.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI 4.1 LI 4.2 LI 4.3 LI 4.4	Unit-4: **Tractor Testing Procedure** 4.1, 4.2, 4.3, 4.4, 4.5, 4.6,4.7	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VIII

Course Code: 29AE821-B

Course Title: Remote Sensing and GIS Applications

Pre-requisite: Student should have understood the advanced concepts and applications of remote sensing and GIS, basics including components, advantages, limitations, and applications in land and water resource assessment; knowledge of the electromagnetic spectrum, energy interactions, atmospheric windows, and spectral reflectance curves for vegetation, soil, and water, environmental management, urban planning, agriculture, natural resource conservation, and disaster management

Rationale: These concepts form the foundation for understanding the use of sensors and platforms, aerial photography, photogrammetric, satellite remote sensing, image classification, GIS components, and their applications in land and water resource management.

Course Outcomes:

AE802.1: Understand the basic components of remote sensing, its advantages and limitations, and its potential use in assessing and monitoring land and water resources.

AE 802.2: Gain knowledge of aerial photography, including types and scales of aerial photographs, stereoscopic vision, air-photo interpretation, and satellite remote sensing techniques.

AE 802.3: Learn about image classification, resolutions, digital data analysis, image enhancement, information extraction, and the use of microwave remote sensing.

AE 802.4: Understand GIS fundamentals, including spatial data sources, entities, structures, map projections, data input methods, editing, and integration of spatial data.

AE 802.5: Apply remote sensing and GIS techniques for effective management of land and water resources.

Scheme of Studies:

Course Criteria	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CL	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Professional Elective Course PEC	29AE821-B	Remote Sensing and GIS Applications	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 ofteacher to ensure outcome of Learning.

Scheme of Assessment:

Theory& Practical

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assess-ment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA +CAT+AT)		
PEC	**29AE821-B**	**Remote Sensing and GIS Applications (Theory)**	0	15	15	0	0	30	50	80
		Remote Sensing and GIS Applications (Practical/Lab)	15	0	0	5	0	20	0	20
		Total								**100**

AE 604.1: Understand principles, techniques, and issues of water harvesting.

Approximate Hours

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Item	CL	LI	SW	SL	Total
Appx. Hrs	7	6	2	2	17

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand the basic components of remote sensing (RS) and its principles.. **SO1.2** Identify the advantages and limitations of RS in the assessment and monitoring of land and water resources. **SO1**.3 Describe the electromagnetic spectrum and energy interactions in the atmosphere and with the Earth's surface. SO1.4 Explain & Recognize typical spectral reflectance curves for vegetation, soil, and water. SO1.5 Explain the principal applications of different wavelength regions in RS. SO1.6 Explain contrast ratio and possible causes of low contrast in remote sensing images.	1.1 Study of Familiarization with Remote Sensing and GIS Hardware; 1.2 To study Use of Software For Image Interpretation; 1.3 To study Interpretation Of Aerial Photographs And Satellite Imagery;	**Unit-1.0 Introduction to Remote Sensing** 1.1 Basic component of remote sensing (RS), advantages and limitations 1.2 RS, possible use of RS techniques in assessment and monitoring of land and water resource 1.3 electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions 1.4 typical spectral reflectance curve for vegetation, soil and water; spectral signatures 1.5 different types of sensors and platforms 1.6. contrast ratio and possible causes of low contrast; 1.7 .Long-term harvesting techniques - purpose and design criteria.,	1.1 Student can develop a solid understanding of remote sensing fundamentals and its applications in land and water resource management 1.2 Experimenting with remote sensing software and datasets can further enhance your skills and knowledge in this field.

Assignments:

- 1. Investigate the concept of contrast ratio in remote sensing imagery and discuss possible causes of low contrast.
- 2. Explore factors such as atmospheric conditions, sensor characteristics, surface properties, and image processing techniques that affect image contrast.

Mini Project:

- Exploring the Fundamentals and Applications of Remote Sensing.
- Study typical spectral reflectance curves for vegetation, soil, and water, understanding their unique spectral signatures.

AE 802.2: Gain knowledge of aerial photography, including types and scales of aerial photographs, stereoscopic vision, air-photo interpretation, and satellite remote sensing techniques.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	8	4	2	2	16

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO 2.1 Understand the scale of aerial photographs and its importance in mapping. **SO 2.2** Understand stereoscopic vision and its role in interpreting aerial photographs.. **SO2.3** Explain the planning of aerial photography, including end lap and side lap. **SO2.4** Describe the requirements for stereoscopic photographs. **S02.5** Explain ground control for aerial photography. **S02.6 Describe** satellite remote sensing and the multispectral scanner, including whiskbroom and push-broom scanner technologies.	2.1 To study Basic GIS Operations Such As Image Display; 2.2 To study Of Various Features Of GIS Software Package; Scanning,	**Unit-2.0 Aerial Photography** **2.1** types of aerial photographs**,** Scale of aerial photographs, 2.2 planning aerial photography- end lap and side lap; **2.3** Stereoscopic vision, requirements of stereoscopic photographs; **2.4** air-photo interpretation **2.5** Interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, **2.6** measurements on a stereo-pair- vertical measurements by the parallax method; **2.7** Ground control for aerial photography; satellite remote sensing **2.8** Multispectral scanner- whiskbroom and push-broom scanner;	1. Understand the characteristics and applications of each type of aerial photograph in various fields, including cartography, urban planning, and environmental monitoring. 2. Study the elements of air-photo interpretation, such as tone, texture, shape, size, pattern, and association. .

Assignments:

1. Define scale in the context of aerial photography and explain how it relates to the ground distance represented in the photograph.
2. Define stereoscopic vision and its significance in interpreting aerial photographs in three dimensions.

Mini Project:

1. Discuss methods for establishing ground control points (GCPs) and their role in improving the accuracy and reliability of aerial survey data.
2. Explain how measurements are made on a single vertical aerial photograph and on a stereo-pair using the parallax method

AE 802.3: Learn about image classification, resolutions, digital data analysis, image enhancement, information extraction, and the use of microwave remote sensing.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	6	2	2	2	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 • Understand the different types of resolutions in remote sensing.. **SO3.2** • Describe the analysis of digital data, including image restoration and enhancement. **SO3.3** • Explain information extraction and image classification. **SO3.4** Understand unsupervised and supervised classification techniques. **SO3.5** Describe microwave remote sensing and its applications. **SO3.6** Explain vegetation indices and their applications in remote sensing.	1.1 Digitization Of Maps And Data Editing; Data Base Query And Map Algebra.	**Unit-3.0 Image Classification** **1.2** Different types of resolutions **1.3** analysis of digital data-image restoration;. **1.4** Image enhancement; information extraction **1.5** Image classification, unsupervised classification, supervised classification, **1.6** Important consideration in the identification of training areas-vegetation indices **1.7** microwave remote sensing	1.1 Study the principles of microwave remote sensing and its advantages in penetrating clouds, vegetation, and soil to observe Earth's surface features. 1.2 Explore important considerations in the identification of training areas for supervised classification, such as sample representativeness, class separability, and spectral variability. .

Assignments:

- Investigate image enhancement methods for enhancing visual interpretation and feature discrimination, including contrast stretching, histogram equalization, and spatial filtering
- Research and understand the concept of spatial, spectral, temporal, and radiometric resolutions in remote sensing imagery.

Mini Project:

Investigate image enhancement methods, including contrast stretching, histogram equalization, and filtering, and their applications in improving image clarity and interpretation.

AE 802.4: Understand GIS fundamentals, including spatial data sources, entities, structures, map projections, data input methods, editing, and integration of spatial data.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	7	2	2	2	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Describe GIS and its basic components. **SO4.2** Describe major components of spatial data in GIS. **SO4.3** Explain the basic classes of map projections and their properties. **SO4.4** Describe methods of data input into GIS and data editing. **SO4.5** Explain attribute data management in GIS. **SO4.6** Describe the integration of data (map overlay) in GIS.	4.1 GIS Supported Case Studies In Water Resources Management .	**Unit-4.0 Foundations of GIS and Spatial Data** 4.1 GIS sand and basic components, different sources of spatial data, 4.2 Basic spatial entities, major components of spatial data, **4.3** Basic classes of map projections and their properties **4.4**Methods of data input into GIS **4.5** Data editing,, **4.6** spatial data models and structures, **4.7** Attribute data management, integrating data (map overlay) in GIS,	1.1 Define Geographic Information Systems (GIS) and explain their role in spatial data analysis and visualization. 1.2 Research different sources of spatial data, such as aerial imagery, satellite imagery, GPS data, and geospatial databases.

Assignments:

- Explore different methods of data input into GIS, including digitization, GPS data collection, remote sensing, and data conversion techniques.
- Explore methods for integrating spatial data layers through overlay operations, such as intersection, union, and difference.

Mini Project:

- Apply your knowledge by completing a small GIS project or exercise, such as creating a simple map, conducting spatial analysis, or performing data integration tasks.

AE 802.5: Apply remote sensing and GIS techniques for effective management of land and water resources.

Approximate Hours

Item	CL	LI	SW	SL	Total
Appx. Hrs	2	0	2	2	6

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Understand the application of remote sensing and GIS for the management of land and water resources. **SO5.2** Identify the role of remote sensing and GIS in environmental monitoring and natural resource management. **SO5.3** Explain the integration of remote sensing and GIS data for decision-making in land and water resource management. .		**Unit-5.0 GIS Data Integration and Applications** 5.1 Application of remote sensing and GIS for the management of land 5.2 Application of remote sensing and GIS for the water resources.	1. Explore how these technologies contribute to data collection, analysis, visualization, and decision-making processes in resource management. 2. Define land and water resources management and its significance for sustainable development and environmental conservation.

Assignments:

- Research case studies and examples where remote sensing and GIS techniques have been successfully applied to address specific land and water resource management challenges.
- Investigate emerging trends and technologies in remote sensing and GIS that are shaping the future of land and water resources management.
- .

Mini Project:

- Create a presentation summarizing key concepts, applications, and case studies related to the use of remote sensing and GIS in land and water resources management.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL +LI + SW + SL)
AE 802.1: Understand the basic components of remote sensing, its advantages and limitations, and its potential use in assessing and monitoring land and water resources.	7	6	2	2	16
AE 802.2: Gain knowledge of aerial photography, including types and scales of aerial photographs, stereoscopic vision, air-photo interpretation, and satellite remote sensing techniques.	8	4	2	2	17
AE 802.3 Learn about image classification, resolutions, digital data analysis, image enhancement, information extraction, and the use of microwave remote sensing. and drop spillways for gully control.	6	2	2	2	12
AE 802.4: Understand GIS fundamentals, including spatial data sources, entities, structures, map projections, data input methods, editing, and integration of spatial data.	7	2	2	2	13
AE 802.5: Apply remote sensing and GIS techniques for effective management of land and water resources.	2		2	2	6
Total Hours	**30**	**14**	**10**	**10**	**64**

Suggestion for End Semester Assessment (ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Introduction to Remote Sensing**	04	05	01	10
CO-2	**Aerial Photography**	04	04	02	10
CO-3	**Image Classification**	05	04	03	11
CO-4	**Foundations of GIS and Spatial Data**	04	05	03	12
CO-5	**GIS Data Integration and Applications**	03	02	02	07
Total		**20**	**20**	**10**	**50**

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

The end of semester assessment Remote Sensing and GIS Applications 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 canal so 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. Demonstration
7. ICT Based Teaching Learning (VideoDemonstration/Tutorials CBT, Blog,Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author/s	Publisher	Edition &Year
1	Textbook of Remote Sensing and Geographical Information Systems	Reddy Anji, M	. . BS Publications, Hyderabad.	2006
2	GIS Fundamentals Applications and Implementations	Elangovan, K	. New India Publication Agency, New Delhi	2006
3	Fundamentals of Remote Sensing. 2nd Edition	George Joseph	Universities Press (India) Private Limited, Hyderabad.	2005
4	Remote Sensing of the Environment An Earth Resource Perspective	Jensen, J.R	. Pearson Education Limited, UK.	2013
5	Remote Sensing and Image Interpretation7th Edition	Lillesand, T., R.W. Kiefer and J. Chipman.	John Wiley and Sons Singapore Pvt. Ltd., Singapore	2015
6	https://elearning.icar.gov.in/eLearningCoursesLibrary.aspx?CoursesType=UG			
7	Lecture note provided by Dept. of Agril. Engineering, AKS University, Satna.			

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Cos, Pos and PSOs Mapping

Course Title: B.Tech. Agricultural Engineering
Course Code: 29AE821-B
Course Title: Remote Sensing and GIS Applications

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO-1 Understand the basic components of remote sensing, its advantages and limitations, and its potential use in assessing and monitoring land and water resources.	2	1	2	2	3	2	3	2	2	1	3	2	2	3	3	3
CO-2 Gain knowledge of aerial photography, including types and scales of aerial photographs, stereoscopic vision, air-photo interpretation, and satellite remote sensing techniques.	2	3	2	2	2	2	3	2	1	1	2	2	2	2	2	1
CO-3 Learn about image classification, resolutions, digital data analysis, image enhancement, information extraction, and the use of microwave remote sensing.	2	2	1	3	2	2	2	2	1	2	1	2	3	2	2	1
CO-4 Understand GIS fundamentals, including spatial data sources, entities, structures, map projections, data input methods, editing, and integration of spatial data.	3	2	2	2	3	2	3	2	2	1	2	3	3	3	3	2
CO-5 Apply remote sensing and GIS techniques for effective management of land and water resources.	2	3	2	1	1	3	3	3	1	1	2	2	3	3	1	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**Understand the basic components of remote sensing, its advantages and limitations, and its potential use in assessing and monitoring land and water resources.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1** **1.2** **1.3**	**Unit 1 : Introduction to Remote Sensing** 1.1,1.2,1.3,1.4,1.5,1.6,1.7	**As Mentioned along with the concern units**
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-2** Gain knowledge of aerial photography, including types and scales of aerial photographs, stereoscopic vision, air-photo interpretation, and satellite remote sensing techniques..	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1** **1.2** **1.3**	**Unit 2: Aerial Photography** 1.1,1.2,1.3,1.4,1.5,1.6,1.7,.1.8	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-3** Learn about image classification, resolutions, digital data analysis, image enhancement, information extraction, and the use of microwave remote sensing.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1** **1.2**	**Unit 3 Image Classification** 1.1,1.2,1.3,1.4,1.5,1.6	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-4** Understand GIS fundamentals, including spatial data sources, entities, structures, map projections, data input methods, editing, and integration of spatial data..	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1**	**Unit 4. Foundations of GIS and Spatial Data** 1.1,1.2,1.3,1.4,1.5,1.6,1.7	
PO 1, 2, 3, 4, 5, 6 7, 8, 9, 10, 11, 12 **PSO 1,2, 3, 4, 5**	**CO-5** Apply remote sensing and GIS techniques for effective management of land and water resources.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 5. GIS Data Integration and Applications** 1.1,1.2,1.3,1.4,	

AKS UNIVERSITY, SATNA

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

B.Tech. (Agricultural Engineering) Programme

Semester-VIII

Course Code:	29AE874-A
Course Title :	Food Plant Design and Management
Pre- requisite:	Students should have basic knowledge of plant design, building and its components along with new ideas, innovation and entrepreneurship development in various food industries.
Rationale:	The students studying Agriculture Engineering should possess foundational understanding about location, selection, design of food plants, salient features of different food processing plants. It also includes the finance, Agri-business management, entrepreneurship development in food industry and export-import policies.

Course Outcomes:

AE803.1: Understand the location, selection and design of food plants.

AE803.2: Interpret the salient features of various food processing plants.

AE803.3: Understand the knowledge about finance and food business management.

AE803.4: Develop skills of entrepreneurship and innovative ideas for new food products.

AE803.5: Understand the knowledge about the various policies and preparation of feasibility report.

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)	
Professional elective courses (PEC)	29AE874-A	Food Plant Design and Management	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

(Theory+ Practical)

Course Criteria	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ ESA)
			Class/Home Assignment (CA) (For Practical	Mid Term-1	Mid Term-2	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
PEC	29AE874-A	**Food Plant Design and Management (Theory)**	0	15	15	0	0	30	50	80
		Food Plant Design and Management (Practical/Lab)	15	0	0	5		20	0	20
		Total								**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.

AE803.1: Understand the knowledge about location, selection and design of food plants.

Approximate Hours

Item	AppX Hrs
CL	4
LI	4
SW	1
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Understand about location and selection criteria of food plant. **SO1.2** Understand about plant capacity and its components. **SO1.3** Acquired plant building and project design. **SO1.4** To learn about selection of equipment, process and its control. **SO1.5** Understand about various objectives and principles of food plant layout.	**1.1** Preparation of project and feasibility report. **1.2** Preparation layout of pre processing house.	**Unit-1.0 Location, selection and design of food plants:** **1.1** Basic knowledge about various requirements of plant building and its components. **1.2** Selection of equipments, process and its control. **1.3** Current status of various food industries in India. **1.4** Layout design about various food plants.	**1.1** Knowledge about current status of various food industries in India. **1.2** Importance and scope of plant designs of various food industries.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Current status of various food industries in India.

b. Mini Project:

i. Flow diagram of food plant layout.

c. Other Activities (Specify):

i. Visit to any one food industry for gaining knowledge about various site locations and other requirements.

AE803.2: Interpret the salient features of various food processing plants.

Approximate Hours

Item	AppX Hrs
CL	4
LI	4
SW	1
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Understand about salient features of processing plants for cereals and pulses. **SO2.2** Understand salient features of processing plants for oilseeds. **SO2.3** Understand salient features of processing plants for Horticultural and vegetables crops. **SO2.4** Understand salient features of processing plants for poultry, fish and meat products **SO2.5** Understand salient features of processing plants for milk and milk products.	**2.1** Evaluation of layout of milk and milk product plants. **2.2** Evaluation of layout of rice mill and bakery and related product plants.	**Unit-2.0** Salient features of various food processing plants: **2.1** Salient features of processing plant for cereals and pulses. **2.2** Salient features of processing plant for oilseeds. **2.3** Salient features of processing plant for horticultural and vegetable crops. **2.4** Salient features of processing plant for milk and milk products.	**2.1** Knowledge about various salient features of various processing plants. **2.2** New advances in various processing plants.

SW-2 Suggested Sessional Work(SW):

a. Assignments:

i. Discuss about various salient features of various processing plants.

b. Mini Project:

Report on recent advances in various processing plants.

c. Other Activities(Specify):

I Visit to any one food industry for gaining knowledge about various salient features of plants.

AE803.3: Understand the knowledge about finance and food business management.

Approximate Hours

Item	AppX Hrs
CL	4
LI	4
SW	1
SL	2
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO3.1 Understand about finance and business analysis of food plants. **SO3.2** Understand about food product marketing. **SO3.3** Understand about food marketing management. **SO3.4** To learn about supply chain management for retail food products. **SO3.5** Analyze of strategic planning.	**3.1** Preparation of different types of records related to production of food plant. **3.2** Study of different types of records related to finance of food plant.	**Unit-3.0** Finance and food business management: **3.1** Basic knowledge about finance. **3.2** Analysis of food business. **3.3** Introduction to food business marketing. **3.4** Knowing about supply chain management for retail food products.	**3.1** Knowledge about food business management. **3.2** Importance and scope of marketing system in food plants.

SW-3 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Discuss about food business management system.
b. Mini Project:
   i. Analysis of strategic planning in food plant.
c. Other Activities (Specify):
   i. Visit of production department of any food plant for business analysis.

AE803.4: Develop skills of entrepreneurship and innovative ideas for new food products.

Approximate Hours

Item	AppX Hrs
CL	4
LI	4
SW	1
SL	2
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO4.1 Understand about entrepreneurship development in food processing plant. **SO4.2** Analyze the SWOT system in various food processing plants. **SO4.3** Acquired knowledge about generation and incubation system in processing plants. **SO4.4** Develop new food product process. **SO4.5** Understand about commercialization of new ideas in various processing plants.	**4.1** Preparation of different types of finance records of processing plants. **4.2** Study about brain storming in processing plants.	**Unit-4.0 Entrepreneurship development and innovative ideas for new food products:** **4.1** Basic knowledge about entrepreneurship development. **4.2** SWOT analysis. **4.3** Generation, incubation and commercialization of new ideas. **4.4** Innovation in new food product development.	**4.1** Knowledge about entrepreneurship development in processing plants. **4.2** Importance of SWOT analysis in processing plants.

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   i. Discuss about entrepreneurship development in processing plants.

b. **Mini Project:**
   i. Discuss about SWOT analysis in processing plants.

c. **Other Activities (Specify):**
   Visit to any one food industry for gaining entrepreneurship skills.

AE803.5: Understand the knowledge about the various policies and preparation of feasibility report.

Approximate Hours

Item	AppX Hrs
CL	4
LI	4
SW	1
SL	2
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Understand about various government schemes for processing plants and incentive for promotion of entrepreneurship. **SO5.2** Understand about various government policies on small and medium scale food processing enterprise. **SO5.3** Acquired knowledge about export and import policies relevant to food processing sectors. **SO5.4** To learn about licensing and registration under FSSAI. **SO5.5** Understand about cost analysis and preparation of feasibility report.	**5.1** Analysis of SWOT system in processing plants. **5.2** Preparation feasibility report.	**Unit-5.0 Various policies and preparation of feasibility report** **5.1** Basic knowledge about government schemes for processing plants. **5.2** Government policies on small and medium scale food processing enterprise. **5.3** Licensing and registration under FSSAI. **5.4** Preparation of detailed project report (DPR).	**5.1** Knowledge about various government schemes and incentive for promotion of entrepreneurship scheme for starting of new food plants. **5.2** Knowledge of DPR for processing plants.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Discuss about various government schemes and incentive for promotion of entrepreneurship scheme for starting of new food plants.

b. Mini Project:

i. DPR for new processing plant.

c. Other Activities (Specify):

Study on licensing and registration system under FSSAI.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+LI+SW+SL)
AE803.1: Understand the location, selection and design of food plants	4	4	1	2	11
AE803.2: Interpret the salient features of various food processing plants.	4	4	1	2	11
AE803.3: Understand the knowledge about finance and food business management.	4	4	1	2	11
AE803.4: Develop skills of entrepreneurship and innovative ideas for new food products.	4	4	1	2	11
AE803.5: Understand the knowledge about the various policies and preparation of feasibility report.	4	4	1	1	11
Total Hours	20	20	5	10	55

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Location, selection and design of food plants.	03	02	01	06
CO-2	Salient features of various food processing plants.	03	05	03	11
CO-3	Finance and food business management.	03	05	03	11
CO-4	Entrepreneurship development and innovative ideas for new food products.	03	05	03	11
CO-5	Various policies and preparation of feasibility report.	03	03	05	11
Total		15	20	15	50

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

The end of semester assessment for Food Plant Design and 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 and Brainstorming.

Suggested Learning Resources:

(a) Textbooks:

S. No.	Title	Author	Publisher	Edition & Year
1	Milk Plant Layout	Hall, H.S. and Rosen, Y.S.	FAO Publication, Rome	IXth Edition, 1963
2	Food Plant Design	Antonio, L.G., Gustavo, V., Barbosa, C.	CRC Press, LLC, USA	Ist Edition, 2005
3	Food Plant Engineering	Robberts Theunis C.	CRC Press, Washington	IInd Edition, 2016

(b) References:

S. No.	Title	Author	Publisher	Edition & Year
1	Food Plant Economics	Maroulis, Z.B. and Saravacos, G.D.	Taylor and Francis, LLC	Ist Edition, 2007
2	Operations Research	Mahajan, M.	Dhanpat Rai and Company Private Limited, New Delhi	IInd Edition, 2016
3	Food Process Design	Maroulis, Z.B.	Marcel Dekker, Inc, Cimarron Road, Monticello, New York 12701, USA	Ist Edition, 2003

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Cos, POs and PSOs Mapping

Course Title: B.Tech. (Agricultural Engineering)

Course Code: 29AE874-A

Course Title: Food Plant Design and Management

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 investing actions 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	To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.	To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.	To inculcate entrepreneurial skills through strong Industry-Institution linkage.	Ability to use the research based innovative knowledge for sustainable development in Agricultural Engineering.
CO 1 : Understand the knowledge about location, selection and design of food plants.	3	3	3	2	3	3	3	2	3	3	3	3	3	3	3	2
CO 2: Interpret the salient features of various food processing plants.	3	3	2	2	3	3	3	2	3	3	3	3	3	3	3	2
CO 3: Understand the knowledge about finance and food business management.	3	3	2	2	3	3	3	2	3	3	3	3	3	3	2	2
CO 4: Develop skills of entrepreneurship and innovative ideas for new food products.	3	3	2	2	3	3	3	2	3	3	3	3	3	3	3	2
CO 5: Understand the knowledge about the various policies and preparation of feasibility report.	3	3	2	2	3	3	3	3	3	3	3	3	3	3	2	2

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	CO 1: Understand the knowledge about location, selection and design of food plants.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1 LI1.2	Unit-1: Location, selection and design of food plants. 1.1,1.2,1.3, 1.4	**As Mentioned along with the concern units**
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 2: Interpret the salient features of various food processing plants.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LI2.1 LI2.2	Unit-2: Salient features of various food processing plants. 2.1, 2.2, 2.3, 2.4.	
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 3: Understand the knowledge about finance and food business management.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	LI3.1 LI3.2	Unit-3: Finance and food business management. 3.1, 3.2, 3.3, 3.4.	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 4: Develop skills of entrepreneurship and innovative ideas for new food products.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LI4.1 LI4.2	Unit-4: Entrepreneurship Development and innovative ideas for new food products. 4.1, 4.2,4.3,4.4,4	
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4	CO 5: Understand the knowledge about the various policies and preparation of feasibility report.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LI5.1 LI5.2	Unit-5: various policies and preparation of feasibility report. 5.1, 5.2, 5.3, 5.4.	