Curriculum Book

and

Assessment and Evaluation Scheme

based on

Outcome Based Education (OBE)

and

Choice-Based Credit System (CBCS)

In

M Sc (Horticulture) in Vegetable Science

2 Year Degree Program

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

AKS University

Satna 485001, Madhya Pradesh, India

Faculty of Agriculture Science and Technology

Department of Horticulture

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Faculty of Agriculture Science and Technology

Department of Horticulture

Curriculum & Syllabus of M.Sc. Horticulture in Vegetable Science program

(Revised as on 01 August 2023)

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Forwarding

I am thrilled to observe the updated curriculum of the Department of Horticulture for M.Sc. Horticulture in Vegetable Science Program, which seamlessly integrates the most recent technological advancements and adheres to the guidelines set forth by ICAR. 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 P.G restructuring committee of ICAR 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 M.Sc. Horticulture in Vegetable Science program for implementation in the upcoming session.

Er. Anant Soni
Pro Chancellor & Chairman
A.K.S. University, Satna

01August 2023

From the Desk of the Vice-Chancellor

AKS University is currently undergoing a process to revamp its curriculum into an outcome-based approach of quality lies in the implementation of a curriculum that aligns with both societal and value needed needs focusing a relevant horticulture out comes. This entails dedicated and inspired faculty members, as well as impactful Horticultural developments. Hence, it is of utmost importance to begin by designing an outcome-based curriculum in collaboration with academia and subject expert.

The curriculum, I am pleased to observe that the Horticulture Department has deli gently adhered to the future prospects of the horticulture in vegetable science. To achieve excellence in the curriculum planning pertaining to horticulture (vegetable science) by periodically updating it in order to provide to Students with sound technical knowledge of outcome based education and to strengthen the research activities in vegetable science by under taking innovative approaches for the Developing the field of horticulture. This curriculum will be beacon of light particularly to the student of Horticulture in Vegetable Science Job/Career prospects in the field of teaching, Research and Extension activities in either Government or Private sector including Greenhouses/poly houses, Horti-business etc.

Further more, the curriculum takes into account the specific needs of restructuring of master's curriculum and academic regulation for the discipline under horticulture science. This curriculum effectively integrates the principles to improve the existing syllabus and to make it none contextual and pertinent to cater the needs of students in terms of global competitiveness and employability.

I am confident that the updated curriculum for horticulture will not only enhance student's technical skills but also contribute significantly to their Employability during the process of revising. The curriculum, I am pleased to observe that the horticulture department has diligently adhered to the guidelines by the As per ICAR PG Restructured and Revised Syllabi of Post-graduate Programmes 2021. They have maintained total credit requirements of 75 M.Sc. horticulture in vegetable science.

Curriculum revision in an ongoing and dynamic process designed to address the continuous evolution of technological advancement and both local and global concerns. AKS University warmly invites input and suggestion from horticulture experts researchers and alumni students to enhance the curriculum and make it more students cantered your valuable insights will gently contribute to shaping as education that best serves the needs and aspirations of the students.

AKS University, Satna
01 August 2023

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

Preface

As part of our commitment to ongoing enhancement, the Department of Horticulture consistently reviews and updates its B.Sc. (Hons.) Agriculture and M.Sc. Horticulture in Vegetable Science Program curriculum every four and two years. Through this process, we ensure that the curriculum remains aligned with the latest technological advancements, as well as local and global industrial and social demands.

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

This curriculum as per guidelines by the P.G restructuring committee of ICAR under Ministry of Agriculture and Farmer welfare, Govt of India. In order to foster the holistic skill development of students, a range of practical activities, including Hands-On Training, Industrial Visits, Project planning and execution, Thesis Writing, Seminars, have been incorporated.

This curriculum is enriched with course components in aligning perfectly with the requisites P.G restructuring committee of ICAR and NAAC standards. In this curriculum, various courses of M.Sc. Horticulture (vegetable Science) enclosed such as Major core course 21 credits, Minor core course 11 credits, Common courses 05 credits, Basic supporting courses 07 credits and Master Research/ Seminar 31 credits.

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

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

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

Dr. S.S. Tomar
Dean, Faculty of Agriculture
Science and Technology
AKS University, Satna

01August 2023

Introduction:

Under Faculty of Agriculture science and Technology the Department of Horticulture Established in 2013, at AKS University, Satna (M.P.) offers highly specialized programs to meet the growing needs of India, both domestically and internationally. We offer M.Sc. (Horticulture) programs with specializations in Vegetable Science. At AKS University, we are committed to equipping our students with the skills and knowledge required to ful fill the needs of India, particularly Madhya Pradesh. Our comprehensive curriculum prepares you for real-world challenges and ensures you are ready to make a meaningful impact in the industry. The demand for trained manpower in the field of Horticulture is skyrocketing. With horticultural crops earning foreign exchange for the country and India's position as the second-highest producer of fruits and vegetables globally, there has never been a better time to pursue a career in horticulture. Our programs open doors to diverse opportunities in farming, processing, marketing, research, and more.

Vision:

Providing excellent teaching and research activities to the students and farmers in Horticulture for frontline areas of vegetable production, propagation, ornamental and landscaping practices, and post-harvest management.

Mission:

M-1: The goal is to provide excellence in teaching and research activities in the area of Vegetable Science Floriculture and Landscaping.

M-2: To enhance the livelihood income of Rural Prosperity by increasing income by providing excellent research findings of production and management, solving their horticulture-related problems and providing quality planting materials.

M-3: To conduct applied and strategic research on improvement and production technology of Vegetable and Flower Crop.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: To develop technical and managerial skills among the students with practical knowledge to work under different field and environmental conditions for vegetable crop production.

PEO2: To apply the acquired knowledge and abilities to academics, research, and development, and make a major contribution to meet the fulfillment of the society.

PEO3: To participate in interdisciplinary and multidisciplinary research sectors to offer superior solutions for production related challenges and fresh concepts for sustainable vegetable production.

PEO4: Entrepreneurship development by harnessing the acquired knowledge and skills of advanced production technologies in vegetable production.

PEO5: To become a face among the farming community through providing support in advance vegetable production technologies.

PROGRAM OUTCOMES (PO_S)

PO1: Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.

PO2: Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables.

PO3: The student will have expertise in nursery-raising techniques and protected cultivation of vegetable crops.

PO4: The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.

PO5: Student will plan about the big scale commercial project and also manage the research trails under vegetable crops.

PO6: Student will apply various statistical methods to analyze their master research work.

PO7: Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing.

PROGRAMME SPECIFIC OUTCOMES (PSO_S)

On completion of M.Sc. Horticulture in Vegetable Science program, the students will achieve the following program specific outcomes:

PSO1: Student will identify different cool season, warm season and underutilized vegetable crops.

PSO2: Student will practice different breeding techniques used in vegetable production.

PSO3: Student will recognize different underutilized vegetable and spice crops.

PSO4: Student will apply different vegetable processing methods for preserving vegetable for long duration.

PSO5: Student will understand role of micro-climate in vegetable crop production under different protected structures.

PSO6: After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects.

PSO7: Student will recognize different flower, ornamental crops and their nursery management.

PSO8: Student will practice turf grass, indoor plant and interior skipping management.

PSO9: Student will apply various information services, technical writings and communication skills in their academics.

PSO10: Student will apply basic concepts in laboratory techniques during their research work.

PSO11: Student will apply basic statistical tools during their research work.

Consistency/Mapping of PEOs with Mission of the Department

PEO	M1	M2	M3
PEO1	2	3	3
PEO2	3	2	3
PEO3	2	2	3
PEO4	2	2	2
PEO5	1	3	2

1*: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) 4: No correlation*

GENERAL COURSE STRUCTURE & THEME

1. Definition of Credit

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

2. Range of Credits:

In the light of the fact that a typical Model Two-year Post Graduate degree program in Agricultural has about 75 credits, the total number of credits proposed for the Two-year M.Sc. Horticulture in Vegetable Science is kept as PG Restructuring committee for ICAR 169 considering NEP-20 and NAAC guidelines.

3. Structure of PG Program in Horticulture:

The structure of PG program in Horticulture 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)	14.20	24
2	Vegetable Sciences (VSC)	14.79	25
3	Humanities and Social Sciences (HMSC)	7.10	12
4	Program Core (PCC)	39.05	66
5	Program Electives (PEC)	5.33	9
6	Open Electives (OEC)	5.33	9
7	Project(s)(PRC)/On job Plant Training (OJT)	10.06	17
9	Seminar (PSC)	1.78	3
10	Indian Knowledge System	1.18	2
11	Sustainable Development Goal	1.18	2
	Total	100.00	**74**

General Course Structure and Credit Distribution
Curriculum of M.Sc. Horticulture in Vegetable Science

Semester-I		**Semester-II**	
Course Title	Credit	Course Title	Credit
1. Production of Cool Season Vegetable Crops	2:0:1 =3	Production of Warm Season Vegetable Crops	2:0:1 =3
2. Growth and Development of Vegetable Crops	2:0:1 =3	Principles of Vegetable Breeding	3:0:0=3
3. Systematics of Vegetable Crops	1:0:1 =2	Protected Cultivation of Vegetable Crops	1:0:1=2
4. Organic Vegetable Production	1:0:1 =2	Production of Underutilized Vegetable Crops	2:0:1 =3
5. Protected Cultivation of Flower Crops	2:0:1 =3	Nursery Management for Ornamental Plants	2:0:1 =3
6. Turfgrass Management	2:0:1 =3	Indoor Plants and Interior scaping	1:0:1 =2
7. Statistical Methods for Applied Science	3:0:1 =4	Experimental Design	2:0:1 =3
8. Library and Information Services	0:0:1 =1	Intellectual Property and Its Management in Agriculture	1:0:0 =1
9. Technical Writing and Communication Skills	0:0:1 =1	Basic Concepts in Laboratory Techniques	0:0:1 =1
Total Credit	**22**	**Total Credit**	**21**
Semester-III		**Semester- IV**	
Course Title	Credit	Course Title	Credit
1. Seminar	0:0:1 =1	1. Thesis/Research	0:0:15 =15
2. Thesis/Research	0:0:15 =15		
3. Agricultural Research, Research Ethics and Rural Development Programs	1:0:0 =1		
Total Credit	**17**	**Total Credit**	**15**

Category-wise Courses

COMMON COURSE

(2compulsory + 2 others)

(i) Common Course: 5, Credits: 5

Sl.	Code No.	Subject	Semester	Credits
1	PGS 501	Library and Information Services	1	0:0:1 =1
2	PGS 502	Technical Writing and Communication Skills	1	0:0:1 =1
3	PGS 503	Intellectual Property and Its Management in Agriculture	2	1:0:0 =1
4	PGS 504	Basic Concepts in Laboratory Techniques	2	0:0:1 =1
5	PGS 505	Agricultural Research, Research Ethics and Rural Development Programs	3	1:0:0 =1
			Total Credits:	**05**

Basic Supporting Courses (BSC) (TOTAL 2)

Sl.	Code No.	Subject	Semester	Credits
1	STAT-502	Statistical Methods for Applied Science	1	3:0:1 =4
2	STAT-511	Experimental Design	2	2:0:1 =3
			Total Credits:	**07**

PROFESSIONAL MAJOR CORE COURSES [PMCC] (Total 8)

Sl.	Code No.	Subject	Semester	Credits
1	VSC- 501	Production of Cool Season Vegetable Crops	1	2:0:1 =3
2	VSC- 503	Growth and Development of Vegetable Crops	1	2:0:1 =3
3	VSC- 510	Systematics of Vegetable Crops	1	1:0:1 =2
4	VSC- 511	Organic Vegetable Production	1	1:0:1 =2
5	VSC- 502	Production of Warm Season Vegetable Crops	2	2:0:1 =3
6	VSC- 504	Principles of Vegetable Breeding	2	2:0:1 =3
7	VSC- 507	Protected Cultivation of Vegetable Crops	2	1:0:1 =2
8	VSC- 509	Production of Underutilized Vegetable Crops	2	2:0:1 =3
			Total Credits:	**21**

PROFESSIONAL MINOR CORE COURSES [PMCC] (Total 4)

Sl.	Code No.	Subject	Semester	Credits
1	FLS - 510	Protected Cultivation of Flower Crops	1	2:0:1 =3
2	FLS - 508	Turfgrass Management	1	2:0:1 =3
3	FLS - 507	Nursery Management for Ornamental Plants	2	2:0:1 =3
4	FLS - 506	Indoor Plants and Interior scaping	2	1:0:1 =2
			Total Credits:	**11**

MASTER RESEARCH / SEMINAR

Sl.	Code No.	Subject	Semester	Credits
1	VSC- 591	Seminar	3	0:0:1 =1
	VSC- 599	Thesis/Research	3	0:0:15 =15
2	VSC- 599	Thesis/Research	4	0:0:15 =15
			Total Credits:	**31**

Induction Program

Induction program for student has 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:

Physical activity

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

Mandatory Visits/Workshop/Expert Lectures:

1. It is mandatory to arrange one industrial visit every semester for the students.
2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
3. It is mandatory to organize at least on expert lecture per semester for each branch by inviting resource persons from industry.

Evaluation Scheme:

For Theory Courses:

1. The weight age of Internal assessment is 50% and
2. End Semester Exam is 50%

The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass

For Practical Courses:

1. The weight age of Internal assessment is 50% and
2. End Semester Examis50%

The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

For Summer Internship/Projects/Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc

Semester wise Course Structure
Semester wise Brief of total Cerits and Teaching Hours

Semester	L	T	P	Total Hour	Total Credit
Semester-I	13	0	9	31	22
Semester-II	13	0	8	29	21
Semester-III	01	0	16	31	17
Semester-IV	0	0	15	30	15
Total	27	0	48	121	75

Details of Semester Wise Course Structure
Semester – I

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	MSC	VSC- 501	Production of Cool Season Vegetable Crops	2		1	4	3
2	MSC	VSC- 503	Growth and Development of Vegetable Crops	2		1	4	3
3	MSC	VSC- 510	Systematics of Vegetable Crops	1		1	3	2
4	MSC	VSC- 511	Organic Vegetable Production	1		1	3	2
5	MSC	FLS- 510	Protected Cultivation of Flower Crops	2		1	4	3
6	MSC	FLS- 508	Turf grass management	2		1	4	3
7	MSC	STAT-502	Statistical Methods for Applied Science	3		1	5	4
8	MSC	PGS 501	Library and Information Services	0		1	2	1
9	MSC	PGS 502	Technical Writing and Communication Skills	0		1	2	1
Total				13	0	9	31	22

Semester – II

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	MSC	VSC- 502	Production of Warm Season Vegetable Crops	2		1	4	3
2	MSC	VSC- 504	Principles of Vegetable Breeding	2		1	4	3
3	MSC	VSC- 507	Protected Cultivation of Vegetable Crops	1		1	3	2
4	MSC	VSC- 509	Production of Underutilized Vegetable Crops	2		1	4	3
5	MSC	FLS - 507	Nursery management for Ornamental Plants.	2		1	4	3
6	MSC	FLS - 506	Indoor plants and Interior scaping	1		1	3	2
7	MSC	STAT-511	Experimental Design	2		1	4	3
8	MSC	PGS 503	Intellectual Property and Its Management in Agriculture	1		0	1	1
9	MSC	PGS 504	Basic Concepts in Laboratory Techniques	0		1	2	1
Total				13	0	8	29	21

Semester – III

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
1	MSC	VSC- 591	Master Seminar	0		1	2	1
2	MSC	VSC- 599	Master's Research	0		15	30	15
3	MSC	PGS- 505	Agriculture Research, Research Ethics and Rural Development Programs	1		0	1	1
Total				01	0	16	31	17

Semester – IV

SN	Category	Code	Course Title	L	T	P	Total Hour	Credit
2	MSC	VSC- 599	Master's Research	0		15	30	15
Total				0	0	15	30	15

AKS University

Faculty of Agriculture Science and Technology

Department Horticulture

Curriculum of M.Sc. Agri Program in Vegetable

Semester-I

Course Code: PGS 501

Course Title: Library and Information Services

Pre-requisite: Student should have basic knowledge of library because course aims to familiarize the learners with the basic concept of use of library services.

Rationale: To impart to the students an understanding of knowledge classification and the theories of library classification, to develop skills in document classification and content analysis. The course provides the opportunity, ensuring freedom and equal access to information for all members of the community, to educate and enlighten them. To maintain and preserve books, materials and resources with historical, cultural, social, economic and archival value, and other related materials in an organized collection to provide members of the community these materials and enriched their personal and professional lives.

Course Outcomes:

CO1. Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.

Scheme of Studies:

Board ofStudy	Course Code	CourseTitle	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
	PGS 501	Library and Information Services	0	1	1	1	3	1

Legend:

CI: Classroom Instruction (Includes different instructional strategies. Lecture(L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performance sin 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: 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**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ESA)
	PGS 501	Library and Information Services							100	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

PGS501.1: Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.

Approximate Hours

Item	Appx Hrs.
Cl	0
LI	30
SW	6
SL	3
Total	39

SessionOutcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	(SL)
SO1.1 Understand the Concept, Definition & Characteristics of Library **SO1.2** Understand the Importance &Functions of Library **SO1.3** Understand the Role of Library and Information Services	1.1 Introduction to library, 1.2 Types of library 1.3 Role of library in society 1.4 Role of Education sector, 1.5 Classification scheme, 1.6 Types of Information sources 1.7 Abstracting and indexing services, 1.8 Use of Databases, OPAC 1.9 Computerized library services 1.10 Library Services 1.11 Online Public Access Catalogue 1.12 Types of Information Centers 1.13 Library Automation 1.14 Create a Digital Library 1.15 Use of e resources		1. How to Accessioning of Books on software 2 How to Books search in Library through the OPAC 3. Difference Between Library and Information Services

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Introduction to library and its services;
2. Role of libraries in education, research and technology transfer,
3. Classification systems and organization of library;
4. Sources of information-, Primary Sources, Secondary Sources and Tertiary Sources;
5. Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);
6. Tracing information from reference sources;

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class lecture (CL)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+SW+SL)
Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.	30	6	3	39

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO1	Library and Information Services		**15**	**35**	**50**

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

The end of semester assessment for Library and Information Services 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:

Sl. No.	Title	Author	Publisher	Edition and Year
01	Foundations of Library and Information Science	Pawan Tripathi	Ansh Book International	
02	Management basics for Information Professionals	G. Edward Evans, Patricia Layzell Ward	Neal Schuman Publishers	
03	Library Classification	P. Tiwari	APH Publishing Corporation	

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Cos, POs and PSOs Mapping
Course Code:- PGS 501
Course Title: - Library and Information Services

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turfgrass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
PGS 501 Able to understand about various concepts	1	1	1	1	1	3	3	1	1	1	1	1	1	1	1	3	3	2

of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts. bulb and tuber crops.																		

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Library and Information Services

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**PGS 501 CO1** Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts bulb and tuber crops.	**SO1.1** **SO1.2** **SO1.3**	1.1 Introduction to library, 1.2 Types of library 1.3 Role of library in society 1.4 Role of Education sector, 1.5 Classification scheme, 1.6 Types of Information sources 1.7 Abstracting and indexing services, 1.8 Use of Databases, OPAC 1.9 Computerized library services 1.10 Library Services 1.11 Online Public Access Catalogue 1.12 Types of Information Centers 1.13 Library Automation 1.14 Create a Digital Library 1.15 Use of e resources		As mentioned in page number ……

Semester- I

Course Code: **PGS502**

Course Title: **Technical writing and communication.**

Pre- requisite: Understanding the principles of various technical writing including thesis, reviews, and abstracts and developing communication skills through the proper use of language.

Rationale: The basic purpose of technical writing is to convey complex information in a simple manner. It explains a topic in detail using proper abstract and citations having communication skills being accessible to a general audience.

Course Outcomes:

PGS 502.1: Learning the various form of scientific writing and implementing skills for Formulation of research based documents.

PGS 502.2: Acquisition of technical communication skill and articulate in English (verbal as writing)

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)	PGS 502	Technical writing and communication.	0	15	2	4	21	0+1

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

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

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 number3 mark each (CA)	Class Test 2 (2 best out of3) 10 marks each (CT)	Seminar one	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
NC	PGS502	Technical writing and communication							100	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.

PGS 502.1: Learning the various form of scientific writing and implementing skills for Formulation of research-based documents.

Approximate Hours

Item	Approximate Hours
CI	00
LI	08
SW	04
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 1.1. To understand about various form writing research documents. SO1.2. To understand about various technical writing approaches for scientific strengting of research documents. SO1.3. To understand about editing and press reading method to avoid plagiarism.	Technical writing 1. Various form of scientific writing – thesis, technical papers, reviews, manuals etc. 2. Various part of thesis and research communication - Title page - Authorship content page - Preface - Introduction - Review of literature - Material and methods - Experimental result - Discussion 3. citations etc. 4. Commonly used abbreviations in the thesis and research communication . 5. Illustrations, photography and drawing with suitable captions pagination numbering of tables and illustrations. 6. Writing of numbers and dates in scientific write ups. 7. Editing and press reading . 8. Writing of review articles.		Enlisting and write description of research communicatio n contents.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Various part of thesis and research communications.
- Writing of abstract, summaries, précis, citations.
- Commonly used abbreviations in the thesis and research communication .
- Write down the principal of editing and press reading.

b. Mini Project:

c. Other Activities (Specify):

PGS 502.2: Acquisition of technical communication skill and articulate in English (verbal as writing)

Approximate Hours

Item	Approximate Hours
CI	00
LI	08
SW	03
SL	02
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. To understand the types, forms, tenses clauses and their uses. SO 2.2. To understand common errors, punctuation in the sentences. SO 2.3. To understand part of speech or word class and their uses. SO 2.4. To understand discussion in groups and interviews.	Communication skill- 1.1 Grammar (Tenses, part of speed, clauses, punctuation marks) 1.2 Error analysis (common error), concord, 1.3collocation, phonetic, symbols and transcription. 1.4 Accentual pattern: weak forms in connected speech. 1.5 Participation in group discussion 1.6 Facing of interview. 1.7 Presentation of scientific paper.		Enlisting and write the description of communication using proper language skills.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1 Writing types of clauses.

2 Writing the sentences using correct punctuation.

3 Writing the types and forms of tenses.

b. Mini Project:

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)
PGS 502.1: Learning the various form of scientific writing and implementing skills for Formulation of research-based documents.	0	2	1	3
PGS 502.2: Acquisition of technical communication skill and articulate in English (verbal as writing)	0	2	1	3

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Technical writing 1.1 Various form of scientific writing – thesis, technical papers, reviews, manuals etc. 1.2 Various part of thesis and research communication Title page Authorship content page Preface Introduction Review of literature Material and methods Experimental result Discussion citations etc. Commonly used abbreviations in the thesis and research communication . Illustrations, photography and drawing with suitable captions pagination numbering of tables and illustrations. Writing of numbers and dates in scientific write ups. Editing and press reading 1.8 Writing of review articles.		**15**	**35**	**50**
CO 2	Communication skill- Grammar (Tenses, part of speed, clauses, punctuation marks) 1.2 Error analysis (common error), concord, collocation, phonetic, symbols and transcription. 1.3 Accentual pattern: weak forms in connected speech. 1.4 Participation in group discussion		**15**	**35**	**50**

	1.5 Facing of interview. 1.6 Presentation of scientific paper.				

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

The end of semester assessment for **Technical writing and communication** 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	Spoken English	Barnes and Noble. Robert C. (Ed.).	Flourish Your Language	2005
2	Technical communication	Mike market Stular A. Selber	Bedford/St. Martins, 12th edition	2017
3	The Essentials of Technical communication	Elizabeth tebeaux sam dragga.	Oxford university press,4th edition	2017
4	Technical writing prosess	Kieran morgan and sanja spajic	Better on paper publications, 1th edition	2015
5	Developing quality technical information	Moira Mcfadden lanyi, Deirdrelongo	IBM press 3th edition	2014

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Cos, POs and PSOs Mapping
Course Code: PGS502
Course Title: - Technical writing and communication

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turfgrass, indoor plant and interiosc apingmanagement	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
PGS 502.1: Learning the various form of scientific writin	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	3	3	3

g and implementing skills for Formulation of research based documents.																		
PGS 502.2: Acquisition of technical communication skill and articulate in English (verbal as writing)	1	1	1	1	1	3	2	1	1	1	1	1	1	1	1	2	3	3

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Technical writing and communication

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**PGS 502.CO1**: Learning the various form of scientific writing and implementing skills for formulation of research based documents.	**SO1.1** **SO1.2** **SO1.3**	Technical writing 1. Various form of scientific writing – thesis, technical papers, reviews, manuals etc. 2. Various part of thesis and research communication - Title page - Authorship content page - Preface - Introduction - Review of literature - Material and methods - Experimental result - Discussion 3. citations etc. 4. Commonly used abbreviations in the thesis and research communication . 5. Illustrations, photography and drawing with suitable captions pagination numbering of tables and illustrations. 6. Writing of numbers and dates in scientific write ups. 7. Editing and press reading . 8. Writing of review articles.		As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**PGS 502.CO2:** Acquisition of technical communication skill and articulate in English (verbal as writing)	**SO2.1** **SO2.2** **SO2.3** **SO2.4**	1. Grammar (Tenses, part of speed, clauses, punctuation marks) 2. Error analysis (common error), concord, 3. collocation, phonetic, symbols and transcription. 4. Accentual pattern: weak forms in connected speech. 5. Participation in group discussion 6. Facing of interview. 7. Presentation of scientific paper.		As mentioned in page number ……

Semester- I

Course Code: **VSC- 511**

Course Title: **Organic Vegetable Production**

Pre- requisite: To elucidate principles, concepts and their applications in organic farming of vegetable crops.

Rationale: Organic vegetable farming is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. Organic farming has been simply defined as a production system working in partnership with nature to produce vegetable crops. The current trend towards increasing popularity of organically produced vegetables is relatively new. The objective of organic farming is to produce safer food and to keep the environment healthy. During the decade of nineties, the interest in organic farming began to creep into the mainstream consumer purchases. Currently, it appears to be an influx of business oriented producers into the organic production field. The increasing popularity of organic food among the elite societies is due to the belief that food produced with this system is free of pesticides and has greater nutritive value than conventionally produced food. The students of vegetable science need to have an understanding of organic vegetable farming technology.

Course Outcomes:

VSC 511.1: To identify the importance and principles of organic farming in vegetable crops.

VSC 511.2: Ability to know the Organic production of vegetable crops.

VSC 511.3: Student able to know the managing soil fertility of vegetable crops.

VSC 511.4: Understand the Composting methods to maintain the soil sustainability.

VSC 511.5: Understand the certification and export of organic vegetable crops.

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)	VSC 511	Organic Vegetable Production	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

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 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
	VSC 511	Organic Vegetable Production	15	30	0	0	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.

VSC 511.1: To identify the importance and principles of organic farming in vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	**03**
LI	**00**
SW	**03**
SL	**02**
Total	**08**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand about the importance of organic farming in vegetable crops. **SO1.2** Understand the principles and perspective of organic farming in vegetable crops. **SO1.3** Understand the concepts and components of organic farming in vegetable crops.		**Unit I** **Importance and principles—Importance, principles, perspective, concepts and components of organic farming in vegetable crops** 1.1Importance of organic farming in vegetable crops 1.2 Principles and perspective of organic farming in vegetable crops 1.3 Concepts and components of organic farming in vegetable crops.	1. Concepts of organic farming in vegetable crops. 2. Components of organic farming.

SW-1 Suggested Sessional Work (SW):

d. Assignments:

- **i.** Components of organic farming
- **ii.** Principles of organic framing
- **iii.** Concept of organic farming

VSC 511.2: Ability to know the Organic production of vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	**05**
LI	**02**
SW	**02**
SL	**02**
Total	**11**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Understand the Organic production of Solanaceous crops such as Tomato, brinjal and chili. SO 2.2. Understand the Organic production of Cucurbitaceous crops such as cucumber, melons and pumpkin. SO 2.3. Application Organic production of Cole crops such as cabbage, cauliflower and broccoli. SO 2.4. Application of Production technology Organic production of root crops such as radish and carrot. SO2.5 Understand the Organic production of tuber crops.	1. Weed, pest and disease management in organic vegetable production	**Unit II** **Organic production of vegetables—Organic production of vegetable crops, viz., Solanaceous, Cucurbitaceous, Cole, root and tuber crops** 2.1 Organic production of Solanaceous crops such as Tomato, brinjal and chili. 2.2 Organic production of Cucurbitaceous crops such as cucumber, melons and pumpkin. 2.3 Organic production of Cole crops such as cabbage, cauliflower and broccoli. 2.4 Organic production of root crops such as radish and carrot. 2.5 Organic production of tuber crops.	1. Organic production technology of tomato. **2.** Organic production technology of cole crops.

SW-2 Suggested Sessional Work (SW):

c. Assignments:

1. Organically integrated nutrient management of vegetable crops.

2. Organically integrated pest management of vegetable crops.

VSC 511.3: Student able to know the managing soil fertility of vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	**03**
LI	**04**
SW	**02**
SL	**03**
Total	**12**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1 Understand the Managing soil fertility, mulching, raising green manure crops. **SO3.2** Application of weed management and crop rotation in organic farming system. **SO3.3** Ability to understand Processing and quality control of organic vegetable produce**.**	1.Use of green manures 2. Application of Soil solarisation.	**Unit III** **Managing soil fertility— Managing soil fertility, mulching, raising green manure crops,** **weed management in organic farming system; Crop rotation in organic production;** **Processing and quality control of organic vegetable produce** **3.1.** Managing soil fertility, mulching, raising green manure crops. **3.2** weed management and crop rotation in organic farming system. **3.3** Processing and quality control of organic vegetable produce	1. Raising green manure crops. 2. Crop rotation 3. Quality control of organic vegetable produce.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

Weed management in organic farming system

Processing and quality control of organic vegetable produce

VSC 511.4: Understand the Composting methods to maintain the soil sustainability.

Approximate Hours

Item	Approximate Hours
CI	**02**
LI	**06**
SW	**03**
SL	**02**
Total	**13**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Application of Composting methods—Indigenous methods of composting, Panchya gavvya, Biodynamics preparations and their application. **SO4.2** Understand the Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops.	1. Methods of preparation and use of compost, vermicompost, biofertilizers and biopesticides. 2.Waste management; Organic soil amendments in organic production of vegetable crops 3. Visit to organic fields and marketing centres.	**Unit IV** **Composting methods—Indigenous methods of composting, Panchya gavvya, Biodynamics preparations and their application; ITKs in organic vegetable farming; Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops** 4.1. Composting methods—Indigenous methods of composting, Panchya gavvya, Biodynamics preparations and their application; 4.2. Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops	1. Different composting methods. 2. bio- control agents in the management of pests and diseases in vegetable crops

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Application of different composting methods such as composting, Panchya gavvya, Biodynamics.

ii. Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops.

iii. ITKs in organic vegetable farming

VSC 511.5: Understand the certification and export of organic vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	**02**
LI	**00**
SW	**02**
SL	**01**
Total	**05**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand 1Techniques of natural vegetable farming, GAP and GMP certification of organic products **SO 5.2** Understand the Export- opportunity and challenges.		**Unit V** **Certification and export-Techniques of natural vegetable farming, GAP and GMP certification of organic products; Export-opportunity and challenges.** Techniques of natural vegetable farming, GAP and GMP certification of organic products. 1.2 Export- opportunity and challenges	GAP and GMP certification of organic products Export-opportunity and challenges of organic products.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Certification techniques in organic products.

ii. Export- opportunity and challenges of organic products.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
VSC 511.1: To identify the importance and principles of organic farming in vegetable crops.	03	03	02	08
VSC 511.2: Ability to know the Organic production of vegetable crops.	07	02	02	11
VSC 511.3: Student able to know the managing soil fertility of vegetable crops.	07	02	03	12
VSC 511.4: Understand the Composting methods to maintain the soil sustainability.	08	03	02	13
VSC 511.5: Understand the certification and export of organic vegetable crops.	02	02	01	05
Total	**27**	**12**	**10**	**49**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Importance and principles—Importance, principles, perspective, concepts and components of organic farming in vegetable crops**	05	03	02	**10**
CO 2	**Organic production of vegetables—Organic production of vegetable crops, viz., Solanaceous, Cucurbitaceous, Cole, root and tuber crops**	04	02	04	**10**
CO 3	**Managing soil fertility—Managing soil fertility, mulching, raising green manure crops, weed management in organic farming system; Crop rotation in organic production; Processing and quality control of organic vegetable produce**	03	03	04	**10**
CO 4	**Composting methods—Indigenous methods of composting, Panchya gavvya, Biodynamics preparations and their application; ITKs in organic vegetable farming; Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops**	04	03	03	**10**
CO 5	**Certification and export—Techniques of natural vegetable farming, GAP and GMP certification of organic products; Export- opportunity and challenges**	6	02	02	**10**
	Total	22	13	15	**50**

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

The end of semester assessment for **Organic Vegetable Production 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:

9. Improved Lecture
10. Tutorial
11. Case Method
12. Group Discussion
13. Role Play
14. Visit to organic fields
15. Demonstration
16. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
17. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Organic farming for sustainable agriculture	Dahama AK.	Agrobios.	2nd Ed. & 2005
2	Organic farming; standards, accreditation certification and inspection	Gehlot G.	Agrobios.	2005
3	Organic farming, theory and practice	Palaniappan SP and Annadorai K.	Scientific publ.	2003
4	Management of horticultural crops	Pradeepkumar T, Suma B, Jyothibhaskar and Satheesan KN.	New India Publ. Agency	2008

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6. Dr. S. K. Chandel, Assistant Professor, Dept. of Horticulture, Faculty of Agriculture Science and Technology AKS University.
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Cos, POs and PSOs Mapping
Course Code:- VSC 501
Course Title: - Organic Vegetable Production

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 511.1: To identify the importance and principles of organic farming in vegetable crops.	1	2	1	1	2	1	1	2	3	3	2	2	1	1	1	1	1	1

VSC 511.2: Ability to know the Organic production of vegetable crops.	1	2	1	2	2	1	1	2	3	2	3	2	1	1	1	1	1	1
VSC 511.3: Student able to know the managing soil fertility of vegetable crops.	1	2	3	2	2	1	1	2	2	3	2	1	1	1	1	1	1	1
VSC 511.4: Understand the Composting methods to maintain the soil sustainability.	3	2	2	2	1	1	1	3	1	2	1	1	2	1	1	1	1	1
VSC 511.5: Understand the certification and export of organic vegetable crops.	2	3	2	3	2	1	1	1	2	2	1	2	1	1	1	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Production of Cool Season Vegetable Crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 511.1: To identify the importance and principles of organic farming in vegetable crops.	**SO1.1 SO1.2 SO1.3**		Unit-1. Importance and principles—Importance, principles, perspective, concepts and components of organic farming in vegetable crops. 1.1, 1.2, 1.3	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 511.2: Ability to know the Organic production of vegetable crops.	**SO2.1 SO2.2 SO2.3 SO2.4 SO2.5**	2.1 Weed, pest and disease management in organic vegetable production	Organic production of vegetables—Organic production of vegetable crops, viz., Solanaceous, Cucurbitaceous, Cole, root and tuber crops 2.1, 2.2, 2.3, 2.4, 2.5	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 511.3: Student able to know the managing soil fertility of vegetable crops.	**SO3.1 SO3.2 SO3.3**	3.1 Use of green manures 3.2 Application of Soil solarisation.	Managing soil fertility—Managing soil fertility, mulching, raising green manure crops, weed management in organic farming system; Crop rotation in organic production; Processing and quality control of organic vegetable produce 3.3, 3.2, 3.3	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 511.4: Understand the Composting methods to maintain the soil sustainability.	**SO4.1 SO4.2**	4.1 Methods of preparation and use of compost, vermicompost, biofertilizers and biopesticides. 4.2Waste management; Organic soil amendments in organic production of vegetable crops 4.3 Visit to organic fields and marketing centres.	Composting methods—Indigenous methods of composting, Panchya gavvya, Biodynamics preparations and their application; ITKs in organic vegetable farming; Role of botanicals and bio-control agents in the management of pests and diseases in vegetable crops 4.1, 4.2	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 511.5: Understand the certification and export of organic vegetable crops.	**SO5.1 SO5.2**		Certification and export—Techniques of natural vegetable farming, GAP and GMP certification of organic products; Export- opportunity and challenges 5.1, 5.2	As mentioned in page number ……

Semester- I

Course Code: **VSC- 501**

Course Title: **Production of Cool Season Vegetable Crops**

Pre- requisite: To impart knowledge and skills on advancement in production technology of cool season vegetable crops

Rationale: Cool season vegetables are a major source of dietary fibers, minerals and vitamins. Some of these vegetables also contribute protein, fat and carbohydrate. Most of the leafy and root vegetables are rich in minerals, especially in micro-elements such as copper, manganese and zinc. Vegetables differ in their temperature requirement for proper growth and development. Most of the winter vegetable crops are cultivated in cool season when the monthly mean temperature does not exceed 21°C. Even in temperate climate, these vegetables are cultivated in spring summer in hilly tracks where the daytime temperature in summer is less than 21°C. The students of vegetable science need to have an understanding of production technology of important cool season vegetable crops and their management.

Course Outcomes:

VSC 501.1: To Understand the Production technology of bulb and tuber crops.

VSC 501.2: Ability to know the package and practices of Cole crops.

VSC 501.3: Student able to know the scientific production technology of root crops.

VSC 501.4: Understand the Package of practices peas and beans.

VSC 501.5: To elaborates the Production technology of leafy vegetable crops.

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)	VSC 501	Production of Cool Season Vegetable Crops	2	1	1	1	4	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 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
PCC	VSC 501	Production of Cool Season Vegetable Crops	15	30	0	0	5	50	50	100

VSC 501.1: To Understand the Production technology of bulb and tuber crops.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**04**
SL	**02**
Total	**18**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand about the 1Nutritional importance, origin and distribution, botany and taxonomy of Onion **SO1.2** Application of production technology onion. **SO1.3** Understand Introduction, commercial and nutritional importance, origin and area, production, productivity and constraints of garlic. SO1.4 Introduces the Package of practices of garlic. SO1.5 Ability to understand the scientific cultivation of tuber crop potato. SO1.6 Understand the Post harvest handling and marketing of potato.	1. to study the Scientific raising of nursery and seed treatment of cool season vegetable crops. 2. Practices of Sowing, transplanting, bulb and tuber crops. 3. To study of description of commercial varieties and hybrids of cool season vegetable crops.	**Unit- 1 Bulb and tuber crops—Onion, garlic and potato.** 1.1Nutritional importance, origin and distribution, botany and taxonomy of Onion 1.2 Production technology of onion 1.3 Introduction, commercial and nutritional importance, origin and area, production, productivity and constraints of garlic. 1.4 Package of practices of garlic. 1.5 scientific cultivation of tuber crop potato. 1.6 Post harvest handling and marketing of potato.	1. improved varieties of bulb and tuber crops. 2. Economical and physiological disorder of bulb and tuber crops.

SW-1 Suggested Sessional Work (SW):

e. Assignments:

iv. Production technology of bulb crops.

v. Production technology of tuber crops.

f. Mini Project:

ii. Varietal description of bulb and tuber crops.

iii. Botanical description of bulb and tuber crops.

VSC 501.2: Ability to know the package and practices of Cole crops.

Approximate Hours

Item	Approximate Hours
CI	**6**
LI	**6**
SW	**3**
SL	**2**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Understand the Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy of cole crops. SO 2.2. Understand the Commercial varieties/ hybrid varieties classification of cole crops. SO 2.3. Application of Package and practices of cabbage and cauliflower. SO 2.4. Application of Production technology of kohlrabi, broccoli, Brussels sprouts and kale. SO2.5 Understand the Post-harvest management (grading, packaging and marketing) of cole crops. SO2.6 Introduce the Pest and disease management and production economics of cole crops.	1. Demonstration on methods of irrigation, fertilizers and micronutrients application of cole crops. 2. To study Mulching practices, weed management of cool season vegetable crops. 3. Use of plant growth substances in cool season vegetable crops	**Unit II** **Cole crops- Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale.** 2.1. Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy of cole crops. 2.2 Commercial varieties/ hybrid varieties classification of cole crops. 2.3 Package and practices of cabbage and cauliflower. 2.4 Production technology of kohlrabi, broccoli, Brussels sprouts and kale. 2.5 Post-harvest management (grading, packaging and marketing) of cole crops. 2.6 Pest and disease management and production economics of cole crops.	3. Improved varieties of cole crops. **4.** Economical and physiological disorder of cole crops.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

3. Package of Practices of cabbage and cauliflower

4. Package of Practices of broccoli, Brussels sprouts

b. Mini Project:

1. Low chart of botanical description of cole crops.

VSC501.3: Student able to know the scientific production technology of root crops.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**03**
SL	**02**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1 Understand the Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints of root crops. **SO3.2** Ability to understand Improved and hybrid varieties of root crops. **SO3.3** Application of Production technology of carrot and radish. **SO3.4** Application of Production technology of turnip and beetroot. **SO3.5** Understand the roles of plant growth regulators, physiological disorders of root crops. **SO3.6** Understand about the Post-harvest management (grading, packaging and marketing), pest and disease management of root crops.	1. To study the use of plant growth substances in root crops. 2. Visit to commercial farm, greenhouse/ polyhouses 3. Identification of important pest and diseases and their control of root crops.	**Unit III** **Root crops—Carrot, radish, turnip and beetroot.** **3.1.** Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints of root crops. **3.2** Improved and hybrid varieties of root crops. **3.3** Production technology of carrot and radish **3.4** Production technology of turnip and beetroot **3.5** roles of plant growth regulators, physiological disorders of root crops. **3.6** Post-harvest management (grading, packaging and marketing), pest and disease management of root crops.	4. Improved varieties of root crops. 5. Post harvest handling of root crops.

SW-3 Suggested Sessional Work (SW):

b. Assignments:

Package of practices carrot and radish

Package of practices turnip and beetroot

c. Mini Project:

Flow chart of botanical description of root crops.

VSC 501.4: Understand the Package of practices peas and beans.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**03**
SL	**02**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints Peas and bean. **SO4.2** Application of Package and practices of garden pea. **SO4.3** Application of Package and practices of broad beans. **SO4.4** Understand the roles of plant growth regulators, physiological disorders in Peas and beans. **SO4.5** Understand the Post-harvest management (grading, packaging and marketing) of Peas and bean. **SO4.6** Introduces the integrated pest and disease management of Peas and beans	1. Analysis of benefit to cost ratio of vegetable crops. 2. Mulching practices, weed management in cool season vegetable crops. 3. Study of nutritional and physiological disorders in cool season vegetable crops.	**Unit IV** **Peas and beans—Garden peas and broad bean.** 4.1. Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints Peas and bean. 4.2. Package and practices of garden pea. 4.3. Package and practices of broad bean. 4.4. roles of plant growth regulators, physiological disorders in Peas and beans 4.5. Post-harvest management (grading, packaging and marketing) of Peas and bean. 4.6 Integrated pest and disease management of Peas and beans	1. Commercial and hybrid varieties of peas and beans 2. Package and practices of peas and beans.

SW-4 Suggested Sessional Work (SW):

b. Assignments:

Package and practices of garden pea

Package and practices of broad beans

c. Mini Project:

i. Flowchart of botanical description of peas and beans

VSC 501.5: To elaborates the Production technology of leafy vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**03**
SL	**02**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand Commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity of leafy vegetables. **SO5.2** Application of Scientific cultivation of beet leaf and fenugreek. **SO5.3**. Application of Production technology of Coriander and lettuce. **SO 5.4.** Understand the Roles of plant growth regulators, physiological disorders in leafy vegetables. **SO5.5** Application of Integrated nutrient management in leafy vegetable crops. **SO 5.6**. Understand the Post-harvest management (grading, packaging and marketing) of leafy vegetable crops.	2. Studies on hydroponics, aeroponics and other soilless culture 3. Preparation of cropping scheme for commercial farms 4. Visit to vegetable market	**Unit V** **Leafy vegetables—Beet leaf, fenugreek, coriander and lettuce.** 1.1. Commercial and nutritional importance, origin and distribution, botany and Taxonomy, area, production, productivity of leafy vegetables. 1.2. Scientific cultivation of beet leaf and fenugreek. 1.3. Production technology of Coriander and lettuce. 1.4. Roles of plant growth regulators, physiological disorders in leafy vegetables. 1.5. Integrated nutrient management in leafy vegetable crops. 1.6. Post-harvest management (grading, packaging and marketing) of leafy vegetable crops.	3. Improved varieties of leafy vegetable crops. 4. Nutritional importance of leafy vegetable crops.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Package of practices of Beet leaf and fenugreek

Package of practices of coriander and lettuce.

b. Mini Project:

Flowchart of botanical description of leafy vegetable corps.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
VSC 501.1: To Understand the Production technology of bulb and tuber crops.	12	04	02	18
Ability to know the package and practices of Cole crops.	12	03	02	17
VSC 501.3: Student able to know the scientific production technology of root crops.	12	03	02	17
501.4: Understand the Package of practices peas and beans.	12	03	02	17
VSC 501.5: To elaborates the Production technology of leafy vegetable crops.	12	03	02	17
Total	**60**	**16**	**10**	**86**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Bulb and tuber crops—Onion, garlic and potato.**	02	06	02	**10**
CO 2	**Cole crops—Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale.**	1	05	04	**10**
CO 3	**Root crops—Carrot, radish, turnip and beetroot.**	04	03	03	**10**
CO 4	**Peas and beans—Garden peas and broad bean.**	07	02	01	**10**
CO 5	**Leafy vegetables- Beet leaf, fenugreek, coriander and lettuce.**	04	03	03	**10**
	Total	**18**	**19**	**13**	**50**

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

The end of semester assessment for **Production of Cool Season Vegetable 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit of commercial horticulture 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	Vegetable crops. Vols. I-III	Bose TK, Kabir J, Maity TK, Parthasarathy VA and Som MG	Naya udyog	2003
2	Vegetable crops	Bose TK, Som MG and Kabir J. (Eds.).	Naya prokash.	1993
3	Advances in horticulture	Chadha KL and Kalloo G. (Eds.).	Malhotra publ. house	2007
4	Hand book of horticulture	Chadha KL	ICAR	2002
5	Vegetable crops: production technology	Fageria MS, Choudhary BR and Dhaka RS.	Kalyani Publishers (2nd Revised Edition)	2000
6	Production technology of vegetable crops.	Singh S P	Agril. comm. res. centre.	1989
7	Vegetables, tuber crops and spices	Thamburaj S and Singh N.	ICAR	2004

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Cos, POs and PSOs Mapping
Course Code: VSC 501
Course Title: - Production of Cool Season Vegetable Crops

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PS O2	PS O3	PSO 4	PS O5	PS O6	PS O7	PS O8	PS O9	PS O10	PS O11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library technique, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post - harvest - handling methods for vegetables and flower	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions as of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interiscapin g management	Student will apply various information service, technical writing and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 501.1 To Understand the Production technology of bulb and tuber crops.	3	3	2	3	3	1	1	3	3	3	3	3	2	1	1	1	1	1
VSC 501.2 Ability to know the package and practices of 1Cole crops	2	3	1	3	2	1	1	2	3	2	3	2	3	1	1	1	1	1
VSC 501.3 Student able to know the scientific	2	2	2	2	3	1	1	3	2	3	2	3	2	1	1	1	1	1

production technology of root crops																		
VSC 501.4 Understand the Package of practices peas and beans	3	2	2	3	2	1	1	3	3	2	3	3	2	1	1	1	1	1
VSC 501.5 To elaborates the Production technology of leafy vegetable crops	2	3	2	3	2	1	1	2	2	2	2	2	3	1	1	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Production of Cool Season Vegetable Crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 501.CO 1: To Understand the Production technology of bulb and tuber crops.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	11. to study the Scientific raising of nursery and seed treatment of cool season vegetable crops. 1.2. Practices of Sowing, transplanting, bulb and tuber crops. 1.3. To study of description of commercial varieties and hybrids of cool season vegetable crops.	**Unit-1.0** Bulb and tuber crops—Onion, garlic and potato. 1.1, 1.2, 1.3. 1.4, 1.5, 1.6	As mentioned in page number ……

PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 501.CO 2: Ability to know the package and practices of 1Cole crops	**SO2.1** **SO2.2** **SO2.3** **SO2.4** **SO2.5** **SO2.6**	2.1. Demonstration on methods of irrigation, fertilizers and micronutrients application of cole crops. 2.2. To study Mulching practices, weed management of cool season vegetable crops. 2.3. Use of plant growth substances in cool season vegetable crops	**Unit-2.0 –** Cole crops- Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale. 2.1, 2.2, 2.3. 2.4, 2.6,	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 501.CO 3: Student able to know the scientific production technology of root crops.	**SO3.1** **SO3.2** **SO3.3** **SO3.4** **SO3.5** **SO3.6**	3.1. To study the use of plant growth substances in root crops. 3.2. Visit to commercial farm, greenhouse/ polyhouses 3.3. Identification of important pest and diseases and their control of root crops.	**Unit-3.0** Root crops—Carrot, radish, turnip and beetroot. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 501.CO 4: Understand the Package of practices peas and beans.	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5** **SO4.6**	4.1. Analysis of benefit to cost ratio of vegetable crops. 4.2. Mulching practices, weed management in cool season vegetable crops. 4.3. Study of nutritional and physiological disorders in cool season vegetable crops	**Unit-4.0** Peas and beans—Garden peas and broad bean**.** 4.1, 4.2, 4.3. 4.4, 4.5, 4.6	As mentioned in page number ……

PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 501.CO 5: To elaborates the Production technology of leafy vegetable crops.	**SO5.1** **SO5.2** **SO5.3** **SO5.4** **SO5.5** **SO5.6**	5.1. Studies on hydroponics, aeroponics and other soilless culture 5.2. Preparation of cropping scheme for commercial farms	**Unit-5.0** Leafy vegetables—Beet leaf, fenugreek, coriander and lettuce. 5.1, 5.2, 5.3. 5.4, 5.5, 5.6	As mentioned in page number

Semester- I

Course Code: VSC 503

Course Title: Growth and Development of Vegetable Crops

Pre- requisite: To teach the physiology of growth and development of vegetable crops.

Rationale: In agriculture, the term plant growth and development is often substituted with crop growth and yield since agriculture is mainly concerned with crops and their economic products. Growth, which is irreversible quantitative increase in size, mass, and/ or volume of a plant or its parts, occurs with an expenditure of metabolic energy. Plant development is an overall term, which refers to various changes that occur during its life cycle. In vegetable crops, development is a series of processes from the initiation of growth to death of a plant or its parts. Growth and development are sometimes used interchangeably in conversation, but in a botanical sense, they describe separate events in the organization of the mature plant body. The students of vegetable science need to have an understanding of growth and development of vegetable crops.

Course outcomes:

VSC-503.1: Students will identify the role of phytohormones and different cellular structures in Vegetable production.

VSC-503.2: Students will review physiology of phytohormones functioning in Vegetable crops.

VSC-503.3: Students will determine the role of light, temperature, photo period, Co_2, O_2, and other gasses on growth and development of vegetable crops

VSC-503.4: Students will locate physiology of dormancy and germination of vegetable seed, tubers and bulbs

VSC-503.5: Students will apply different grafting techniques in Vegetable crops

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 (GDVC)	VSC-503	Growth and Development of Vegetable Crops	2	1	1	1	5	3

Legend:

CI: Class room Instruction (Includes different instruction all strategies i.e. Lecture(L) and Tutorial (T) and others),

LI: Laboratory Instruction (Include 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&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackofteacherto 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	Total Marls
			Class/Home Assignment1 number 5 marks each (CA)	Class Test2 (2bestout) 15 marks each (CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT+PA+AT)	**(ESA)**	(PRA+ ESA)
GDVC	VSC-503	Growth and Development of Vegetable Crops	5	30	10	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 how case their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

VSC-503.1: Students will identify the role of phytohormones and different cellular structures in Vegetable production.

Approximate Hours

Item	Approximate Hours
CI	**07**
LI	**02**
SW	**03**
SL	**02**
Total	**14**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Student will understand the functions of various cellular structures within the plant system. **SO1.2**Student will recognize the phytohormones functioning/ biosynthesis and mode of action of various growth hormones in vegetables. **SO1.3**Student will apply different growth analysis techniques and its importance in vegetable production.	1 Growth analysis techniques in vegetable crops.	**Unit-1.0**Introduction and phytohormones—Definition of growth and development; Cellular structures and their functions; Physiology of phytohormones functioning/biosynthesis and mode of action; Growth analysis and its importance in vegetable production. **1.1**Phytohormones—Definition and Importance of growth and development. **1.2**Cellularstructures and their functions. **1.3**Phyto-hormones functioning in Vegetables. **1.4**biosynthesis of Phytohormones in vegetable crops. **1.5** Mode of action of phytohormones in vegetable crops. **1.6**Growth analysis techniques. **1.7** Importance of Growth analysis techniques in vegetable production.	1. Major cell organelles their functions. 2. Growth analysis factors.

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Preparation of file and write all growth analysis factors and their purpose.

ii. Prepare the list of cell organelles with figures and write their functions.

Other Activities (Specify):

Identification of cell organelles in laboratory through compound microscope

VSC-503.2: Students will review physiology of phytohormones functioning in Vegetable crops.

Approximate Hours

Item	App X Hrs
Cl	07
LI	04
SW	01
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO2.1 Students will understand the role of dormancy and germination in vegetable seeds, tubers and bulbs and role of auxins, gibberellilns, cyktokinins and abscissic acid **SO2.2**Studentswill apply synthetic PGRs including plant growth retardants and inhibitors for various purposes in vegetable crops. **SO2.3**Studentswill identify the role and mode of action of morphactins,antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production.	1.Preparation of plant growth regulator's solutions and their application. 2.Experiments in breaking and induction of dormancy by chemicals;	**Unit-2**Physiology of dormancy and germination—Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellilns, cyktokinins and abscissic acid; Application of synthetic PGRs including plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production. **2.1**Importance of dormancy and germination. **2.2**Physiology of dormancy and germination of vegetable seeds, tubers and bulbs. **2.3**Role of auxins andgibberellilns,in Vegetable crop production. **2.4**Role of cyktokinins and abscissic acidin Vegetable crop production **2.5** Application of synthetic PGRs, plant growth retardants and inhibitors in vegetable crops **2.6** Role and mode of action of morphactins, antitranspirants, anti-auxinin vegetable crops. **2.7**Role and mode of action of ripening retardant and plant stimulants in vegetable crops.	1.Synthetic and natural Phytohormones.

SW-2 Suggested Seasonal Work (SW):

a. Assignments:

i. Note on synthetic and natural phytohormone and their uses

VSC-503.3: Students will determine the role of light, temperature, photoperiod, Co_2, O_2, and other gasses on growth and development of vegetable crops.

Approximate Hours

Item	App X Hrs
Cl	04
LI	02
SW	01
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 Identify the abiotic factors and their Impacton growth and development of underground parts. **SO3.2**Students will understand the role offlowering and sex expression in vegetable crops.	1.Application of plant growth substances for improvingflower initiation,changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables.	**Unit-3:** Abiotic factors—Impact of light, temperature, photoperiod, carbon dioxide, oxygen and other gases on growth, development of underground parts, flowering and sex expression in vegetable crops; Apical dominance. **3.1**Role of light, temperature, photoperiod in vegetable crops. **3.2**Role of carbon dioxide, oxygen and other gases on growth, development of underground parts. **3.3**Flowering and sex expression in vegetable crops. **3.4**Role of apical dominance in plants.	Biotic and abiotic factors.

SW-3Suggested Sessional Work (SW):

a. Assignments:

i. Note on Biotic and abiotic factors and their impact on vegetable crops.

VSC-503.4: Students will locate physiology of dormancy and germination of vegetable seed, tubers and bulbs.

Approximate Hours

Item	App X Hrs
Cl	09
LI	02
SW	02
SL	01
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the Physiology of fruit set, fruit development, fruit growth, flower and fruit drop. **SO4.2**Understand the parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission in Vegetables**.** **SO4.3**Understand the fruit ripening and physiological changes associated with ripening in vegetable crops**.**	1.Induction of parthenocarpy and fruit ripening.	**Unit-4.0** Fruit physiology—Physiology of fruit set, fruit development, fruit growth, flower and fruit drop parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening. **4.1**Fruit physiology—Physiology of fruit setin Vegetables **4.2** Fruit development and fruit growth in Vegetables. **4.3**flower and fruit dropin Vegetables. **4.4**Parthenocarpy in vegetable crops. **4.5** Phototropism in vegetable crops. **4.6**Ethylene inhibitors used in vegetable crops **4.7** senescence and abscissionin Vegetables. **4.8**fruit ripening process in vegetables **4.9**physiological changes associated with ripening.	i. fruit associated with parthenocarpy. ii. Physiology of fruit and types.

SW-4Suggested Sessional Work (SW):

a. Assignments:
Note on parthenocarpy, phototropism, ethylene inhibitors, senescence and abscission.

d. Other Activities (Specify):
i. Visit to post harvest laboratory

VSC-503.5: Students will apply different grafting techniques in Vegetable crops.

Approximate Hours

Item	App X hrs
Cl	03
LI	02
SW	02
SL	01
Total	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**SelfLearning (SL)**
SO5.1 Students will apply the Morphogenesis and tissue culture techniques in Vegetable crops. **SO5.2**Students will apply the various Grafting techniques in different vegetable crops.	1.Grafting techniques in tomato, brinjal, cucumber and sweet pepper.	**Unit5:** Morphogenesis and tissue culture—Morphogenesis and tissue culture techniques in vegetable crops; Grafting techniques in different vegetable crops. **5.1.** Morphogenesis techniques uses in Vegetable. 5.**2.** Importance of tissue culture techniques in vegetable crops. **5.3**. Grafting techniques in different vegetable crops.	1. Morphogenesis and tissue culture techniques associated with vegetable crops.

SW-5Suggested Sessional Work (SW):

Assignments:

Note on Grafting techniques followed in major vegetables.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
VSC-503.1: Students will identify the role of phytohormones and different cellular structures in Vegetable production.	09	03	02	14
VSC-503.2: Students will review physiology of phytohormones functioning in Vegetable crops.	11	01	01	13
VSC-503.3: Students will determine the role of light, temperature, photo period, Co_2, O_2, and other gasses on growth and development of vegetable crops.	06	01	01	08
VSC-503.4: Students will locate physiology of dormancy and germination of vegetable seed, tubers and bulbs.	11	02	01	14
VSC-503.5: Students will apply different grafting techniques in Vegetable crops.	05	02	01	08
Total	**38**	**09**	**06**	**57**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Introduction and phytohormones—Definition of growth and development; Cellular structures and their functions; Physiology of phytohormones functioning/biosynthesis and mode of action; Growth analysis and its importance in vegetable production	05	03	02	10
CO 2	Physiology of dormancy and germination—Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellilns, cyktokinins and abscissic acid; Application of synthetic PGRs including plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production.	05	03	02	10
CO 3	Abiotic factors—Impact of light, temperature, photoperiod, carbon dioxide, oxygen and other gases on growth, development of underground parts, flowering and sex expression in vegetable crops; Apical dominance.	04	03	03	10
CO 4	Fruit physiology—Physiology of fruit set, fruit development, fruit growth, flower and fruit drop parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening.	5	03	02	10
CO 5	Morphogenesis and tissue culture—Morphogenesis and tissue culture techniques in vegetable crops; Grafting techniques in different vegetable crops.	4	02	04	10
	Total	22	13	15	50

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

The end of semester assessment for **Growth and Development of Vegetable 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to organic fields
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	Plant physiology in relation to horticulture	Bleasdale JKA	OXford and IBH.	2nd Ed. & 1984
2	Vegetable grafting: Principles and practices	Kalloo G	Tata McGraw Hill.	2017
3	Plant growth and development	Leopold AC and Kriedemann PE.	Tata McGraw-Hill.	1981
4	Hand book of vegetables	Peter KV and Hazra P	Studium Press LLC	2012
5	Basics of horticulture	Peter KV	New India publication agency New Delhi	2008
6	Physio-biochemistry and Biotechnology of Vegetables	Rana MK. 2011	New India Publishing Agency	2011
7	Laboratory manual of analytical techniques in horticulture	Saini et al	Agro bios, Jodhpur.	2001
8	The physiology of vegetable crops	Wien HC.	CAB International.	1997

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Cos, POs and PSOs Mapping

Course Code: VSC 503

Course Title: - Growth and Development of Vegetable Crops

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library technique, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interiosciping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC-503.	2	2	3	3	3	1	1	3	3	3	3	3	2	1	1	1	1	1

1: Students will identify the role of phyto hormones and different cellular structures in Vegetable production																			
VSC-503.2: Students will review physiology of phyt	2	2	3	2	3	2	1	2	3	2	3	2	3	1	1	1	1	1	

ohormones functioning in Vegetable crops.																		
VSC-503.3: Students will determine the role of light, temperature, photo period, Co_2, O_2, and other gasses on growth and development	2	2	2	2	3	1	1	3	2	3	2	3	2	1	1	1	1	1

of vegetable crops																		
VSC-503.4: Students will locate physiology of dormancy and germination of vegetable seed, tubers and bulbs	2	2	2	3	2	1	1	3	3	2	3	3	2	1	1	1	1	1
VSC-503.5: Students will apply different grafting techniques in	2	2	2	2	3	2	1	2	2	2	2	2	3	1	1	1	1	1

Vege table crops																		

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Production of Cool Season Vegetable Crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**VSC-503 CO.1**: Students will identify the role of phytohormones and different cellular structures in Vegetable production.	**SO1.1** **SO1.2** **SO1.3**	11. Growth analysis techniques in vegetable crops.	**Unit-1.0** Introduction and phytohormones—Definition of growth and development; Cellular structures and their functions; Physiology of phytohormones functioning/biosynthesis and mode of action; Growth analysis and its importance in vegetable production. 1.1, 1.2, 1.3. 1.4, 1.5, 1.6, 1.7	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**VSC-503 CO.2**: Students will review physiology of phytohormones functioning in Vegetable crops.	**SO2.1** **SO2.2** **SO2.3**	2.1. Preparation of plant growth regulator's solutions and their application. 2.2. Experiments in breaking and induction of dormancy by chemicals;	**Unit-2.0 –** Physiology of dormancy and germination—Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellilns, cyktokinins and abscissic acid; Application of synthetic PGRs including plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production. 2.1, 2.2, 2.3. 2.4, 2.6, 2.7	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7,	**VSC-503 CO.3**: Students will determine the role	**SO3.1**	3.1. Application of plant growth substances for	**Unit-3.0** Abiotic factors—Impact of light,	As mentioned in page

8, 9, 10, 11	of light, temperature, photo period, Co_2, O_2, and other gasses on growth and development of vegetable crops	**SO3.2**	improvingflower initiation,changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables.	temperature, photoperiod, carbon dioxide, oxygen and other gases on growth, development of underground parts, flowering and sex expression in vegetable crops; Apical dominance. 3.1, 3.2, 3.3, 3.4	number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**VSC-503 CO.4**: Students will locate physiology of dormancy and germination of vegetable seed, tubers and bulbs	**SO4.1** **SO4.2** **SO4.3**	4.1. Induction of parthenocarpy and fruit ripening.	**Unit-4.0** Fruit physiology—Physiology of fruit set, fruit development, fruit growth, flower and fruit drop parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening. 4.1, 4.2, 4.3. 4.4, 4.5, 4.6, 4.7, 4.8, 4.9	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**VSC-503 CO.5**: Students will apply different grafting techniques in Vegetable crops	**SO4.1** **SO4.2**	5.1. Grafting techniques in tomato, brinjal, cucumber and sweet pepper.	**Unit-5.0** Morphogenesis and tissue culture—Morphogenesis and tissue culture techniques in vegetable crops; Grafting techniques in different vegetable crops. 5.1, 5.2, 5.3	As mentioned in page number ……

Semester- I

Course Code: FLS 510

Course Title: Protected Cultivation of Flower Crops

Pre- requisite: Understanding the principles, theoretical aspects and developing skills in protected cultivation of flower crops.

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Rationale: Protected cultivation is more rewarding in production of high value cut flowers. With appropriate structures and plant environment control measures, the constraints of environment prevalent in the region can be overcome allowing almost year-round cultivation. The students need a thorough understanding of principles, types, designs, crops for different environments and management of environment in protected cultivation.

Course Outcomes:

FLS 510.1: Knowledge on types, design and principles of protected structures.

FLS 510.2: Thorough understanding of specific design and exction of protected structure as well as structural comments**.**

FLS 510.3: Thorough understanding of principles of microclimate management and crop management

FLS510.4: Develop the required skill for production management of valuable flower crop production.

FLS510.5: Acquire skills on microclimate management, production 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**	
Program Core (PCC)	FLS 510	Protected Cultivation of Flower Crops	2	1	1	1	5	2+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

Board of Study	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		(PRA + ESA)
PCC	FLA 510	Protected Cultivation of Flower Crops	15	30	0	0	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.

FLS 510.1: Knowledge on types, design and principles of protected structures.

Approximate Hours

Item	Approximate Hours
CI	03
LI	02
SW	03
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 1.1. Apply knowledge about the prospect of protected floriculture in India. SO 1.2. Understand about the types of protected structures Glass house / P.H/S.H/M.C/ L.H. SO 1.3. Application of various protected structure for cultivation of flower crops.	1.Study of various protected structures	**Unit-1. Prospect and type of protected structure: Prospect of protected floriculture in India, types of protected structures-glass house, poly house, shade net house, mist chambers, lath house orchiderium, femery, rain shelters etc.** 1.1. Prospect of floricultures in India 1.2. Types of protected structure glass house, poly house, shade net house, mist chambers, lath house. 1.3. Types of protected structure for some specific floriculture plant Purpose: orchiderium, femery, rainshelters etc.	1.Enlist different protected structure with special reference of floriculture crops

SW-1 Suggested Sessional Work (SW):

g. Assignments:

vi. Prospect of protected floriculture in India at present scenario, Types of protected structure glass house, poly house.

h. Mini Project:

iv. Prepare modal of types of Prospect structure poly house, shade net house, mist chambers.

i. Other Activities (Specify):

Visit to poly house unit and know about its structure design at university campus, as well as shed net house design for nursery purpose.

FLS 510.2: Thorough understanding of specific design and exction of protected structure as well as structural comments.

Approximate Hours

Item	Approximate Hours
CI	03
LI	02
SW	02
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Understand about principal designing and erection of protected structures SO 2.2. Apply knowledge for location specific design protected structures. SO 2.3. Application of suitable criteria for selection of suitable flowers foliage plant for protected structures SO 2.4. Apply proper technical approaches for design layout and erection of different types protected structures.	1. Design layout and erection of different types protected structures.	**2. principal designing and erection of protected structures: low cost / medium cost/ high cost structures, location specific design structural components: suitable flowers and foliage plant for protected cultivation**. 2.1. Principal, Designing and exaction of low cost / medium cost/ high cost structures. 2.2. location specific design of protected structure, 2.3. Structural components: growing of suitable foliages plant under protected structure,	1.Enlist different suitable flower and foliages plant for protected structures with specific parameters

SW-2 Suggested Sessional Work (SW):

a. Assignments:

5. principal designing of protected structure, Structural components: growing of suitable foliages plant under protected structure,.

b. Mini Project:

Prepare chat of location specific design of protected structure.

ci. Other Activities (Specify):

FLS 510.3: Thorough understanding of principles of microclimate management and crop management

Item	Approximate Hours
CI	06
LI	02
SW	04
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1. Understand about microclimate management system under protected unit. **SO 3.2.** Application heating and cooling systems in protected cultivation unit. **SO 3.3.** Understand about fan and pad cooled green house. **SO 3.4.** Application of light regulation system and water harvesting technique to grow valuable flower crop under protected unit.	1. microclimate management	**Unit 3 Control of environment: microclimates management and manipulation of temperature light humidity, air and co_2: heating and cooling systems, ventilation, naturally ventilated green house, fan and pad cooled greenhouses light regulation, water harvesting** **3.1.** Microclimates management and manipulation of temperature light humidity, air and co_2 **3.2.** Heating and cooling systems. **3.3.** Ventilation **3.**4. Naturally ventilated green house. **3.5** Fan and pad cooled green house. **3.6.** light regulation, water harvesting	1.To Enlist the system use for different microclimates management practices in special reference to protected cultivation.

SW-3 Suggested Sessional Work (SW):

d. Assignments:

i. Microclimates and manipulation system with special reference to all atmospheric parameter,

ii. Ventilation systems**,** fan and pad cooled green-houses light regulation, water harvesting

e. Mini Project:

i. Prepare modal of humidity control system in protected unit. Water harvesting techniques adopted to minimum use of irrigation water in protected unit .

f. Other Activities (Specify):

i. Visit to hi-tech unit of green-house technology system to know about environment control measures fallow for successful offseason production of flower.

FLS 510.4: Develop the required skill for production management of valuable flower crop production.

Item	Approximate Hours
CI	06
LI	04
SW	03
SL	02
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 4.1. Understand about inter culture operation and crop regulation. SO 4.2. Application of containers and substrates medias, soil decontamination SO 4.3. Understand application and instralltion of drip and irrigation system , under water nutrient management practices SO 4.4.Application of crop regulator by using chemical to manipulate and ensure quality production of flower crops . SO 4.5. To apply special horticulture practices to ensure growth, development and yield of flower crop under protected unit.	1. Practices in preparatory operations , growing media soil decontamination techniques 2. practices in drip irrigation and fertigation techniques ,special horticulture practices	**Unit 4: Intercultural operations and crop regulation; containers and substrates media, soil decontamination layout of drip and fertigation system, water and nutrient management ,IPM and IDM ,crop regulation by chemical methods, and special horticultural practices (pinching, disbudding deshooting, deblossoming etc)staking and netting, photoperiod regulation .** 4.1. Intercultural operations and crop regulation 4.2. Containers and substrates media soil decontamination 4.3 Drip irrigation and fertigation system 4.4 Water and nutrient management. 4.5. IPM and IDM 4.6. Crop regulation by chemical methods and various special horticulture practices fallowed for qualitative flower crop production	(A) Enlist the media use flower production under protected cultivation (B) Definition of special horticulture practices follow for quality flower production .

SW-4 Suggested Sessional Work (SW):

d. Assignments:

i. Interculture operations and crop regulation ; containes and substrate media ;lay out of drip irrigation system ;special horticulture practices

e. Mini Project:

1. Make a model of drip and fertigation system.
2. Special horticulture practices fallowed in cut flower production under poly house condition.

f. Other Activities (Specify):

FLS 510.5: Acquire skills on microclimate management, production management.

Item	Approximate Hours
CI	05
LI	08
SW	03
SL	01
Total	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 5.1.Application of automation and standards in green house technology. SO 5.2. To understand about Export –Import standards and policy SO 5.3.Apply post harvest handling practices for flower production under protected structure SO 5.4.Formation of economic of cultivation and project preparation . SO 5.5. Understand about commercial green house by visit of students .	5.1 Post harvest handling packaging methods . 5.2 Economic of cultivation, project preparation 5.3 Project financing guidelines 5.4 Visit to commercial green house	**Unit-5 Automation and standerds: automation in green house sensors solar green house, retracable green house, GAP/flower labels, export standerds, EXIM policy APEDA regulations for export, non –tariff barriers .** Automation in green house, sensors, solar green house, GAP/flower labels, retractable green house Export standards EXIM policy APEDA regulation for export Non tariff.	1. List out the export standards and EXIM policy for standardization of flower production under protected units.

SW-5 Suggested Sessional Work (SW):

b. Assignments:

ii. Automation and standards in green house, export standards for flower crops production, APEDA regulation for export of flower .

c. Mini Project:

ii. To make a project preparation including economic standard for cultivation of cut –rose under protected structure .

c. Other Activities (Specify):

Visit to commercial greenhouse unit at university.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
FLS 510.1: Knowledge on types, design and principles of protected structures.	5	3	1	08
FLS 510.2: Thorough understanding of specific design and exction of protected structure as well as structural comments **.**	5	2	1	08
FLS 510.3: Thorough understanding of principles of microclimate management and crop management.	8	4	1	13
FLS510.4: Develop the required skill for production management of valuable flower crop production.	10	3	2	15
FLS510.5: Acquire skills on microclimate management , production management .	13	3	1	18

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Prospect and type of protected structure: Prospect of protected floriculture in India , types of protected structures- glass house, poly house, shade net house, mist chambers, lath house orchiderium , femery, rain shelters etc.	4	4	2	10
CO 2	principal designing and erection of protected structures:- low cost / medium cost/ high cost structures, location specific design structural components: suitable flowers and foliage plant for protected cultivation.Rose, Chrysanthemum, Carnation, Gerbera, Orchids, Anthuriums, Lilium, Limonium, Lisianthus, heliconia, Cala lily, Alstromeria, etc.	3	4	3	10
CO 3	Control of environment: microclimates management and manipulation of temperature light humidity, air and co_2 : heating and cooling systems, ventilation, naturally ventilated green house , fan and pad cooled green houses light regulation, water harvesting	4	2	4	10
CO 4	Intercultural operations and crop regulation; containers and substrates media , soil decontamination lay out of drip and fertigation system ,water and nutrient management ,IPM and IDM ,crop regulation by chemical methods , and special horticultural practices (pinching, disbudding deshooting , deblossoming etc)staking and netting, photoperiod regulation .	2	3	5	10
CO 5	Automation and standerds: automation in green house sensors solar green house, retracable green house, GAP/flower labels, export standerds, EXIM policy APEDA regulations for export, non –tariff barriers .	5	3	2	10
	Total	18	16	16	50

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

The end of semester assessment for **Protected Cultivation of Flower 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:

18. Improved Lecture
19. Tutorial
20. Case Method
21. Group Discussion
22. Role Play
23. Visit to different protected cultivation unit at satna disrict
24. Demonstration
25. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
26. Brainstorming

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Advances in Ornamental Horticulture	Bhattacharjee SK	Pointer Publ.Reprint, pp. 2065.	2018
2	Floriculture and Landscaping	Bose TK, Maiti RG, Dhua RS and Das P	Naya Prokash Kolkata, India.	1999
3	Commercial Flowers	Bose TK and Yadav LP.	Naya Prokash, Kolkata, India.	1989
4	Advances in Horticulture: Ornamental Plants	Chadha KL and Bhattacharjee SK	Malhotra Publ. House, New Delhi, India,	1995
5	Floriculture-Fundamentals and Practices	Lauria A and Victor HR	Agrobios Publ., Jodhpur.	2001
6	Commercial Floriculture.	Prasad S and Kumar U	Agrobios Publ., Jodhpur.	2003
7	Floriculture in India	Randhawa GS and Mukhopadhyay A	Allied Publ.	1986
8	Hi- Tech Floriculture	Reddy S, Janakiram T, Balaji T, Kulkarni S and Misra RL	Indian Society of Ornamental Horticulture, New Delhi, India	2007
9	Green House Operation and Management	Nelson PV.	Pearson Publ. 7th edition, pp. 624	2011

Curriculum Development Team:

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2. Dr. Abhishek Singh, HOD, Dept. of Horticulture, Faculty of Agriculture Science and Technology AKS University.
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7. Mr. Ansul Asre, Teaching Associate, Dept. of Horticulture, Faculty of Agriculture Science and Technology AKS University.

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
FLS 510.1 Knowledge on types, design and principles	1	2	3	1	1	1	1	1	1	1	2	3	1	3	2	1	1	1

of protected structures.																		
FLS510.2 Thorough understanding of specific design and execution of protected structure as well as structural comments.	1	1	3	1	2	1	1	1	2	3	2	1	1	1	1	1	1	1
FLS510.	3	1	3	2	1	1	1	1	1	2	1	1	3	1	1	1	1	1

3 Thorough understanding of principles of microclimate management and crop management.																		
FLS 510.4 Thorough understanding of principles of microclimate mana	3	1	2	3	1	1	1	2	3	1	2	3	2	1	1	1	1	1

gement and crop management																		
FLS 510.5 Acquire skills on microclimate management, production management.	3	3	2	3	2	1	1	2	2	2	2	2	3	1	1	1	1	1

Cos, POs and PSOs Mapping
Course Code: FLS 510
Course Title: - Protected Cultivation of Flower Crops

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Protected Cultivation of Flower Crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 510.CO 1: Knowledge on types, design and principles of protected structures.	**SO1.1** **SO1.2** **SO1.3**	1.1. Study of various protected structures.	**Unit-1.0** Prospect and type of protected structure: Prospect of protected floriculture in India, types of protected structures- glass house, poly house, shade net house, mist chambers, lath house orchiderium, femery, rain shelters etc. 1.1, 1.2, 1.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 510.CO 2: Thorough understanding of specific design and exction of protected structure as well as structural comments.	**SO2.1** **SO2.2** **SO2.3** **SO2.4**	2.1. Design layout and erection of different types protected structures.	**Unit-2.0 –** principal designing and erection of protected structures:- low cost / medium cost/ high cost structures, location specific design structural components: suitable flowers and foliage plant for protected cultivation. 2.1, 2.2, 2.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 510.CO 3: Thorough understanding of principles of microclimate management and crop management.	**SO3.1** **SO3.2** **SO3.3** **SO3.4**	3.1. Microclimate management.	**Unit-3.0** Control of environment: microclimates management and manipulation of temperature light humidity, air and co2: heating and cooling systems, ventilation, naturally ventilated green house , fan and pad cooled green houses light regulation, water harvesting. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	As mentioned in page number ……

PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 510.CO 4: Develop the required skill for production management of valuable flower crop production.	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5** **SO4.6**	4.1. Practices in preparatory operations, growing media soil decontamination techniques. 4.2. Practices in drip irrigation and fertigation techniques ,special horticulture practices	**Unit-4.0** Intercultural operations and crop regulation; containers and substrates media, soil decontamination lay out of drip and fertigation system, water and nutrient management, IPM and IDM, crop regulation by chemical methods, and special horticultural practices (pinching, disbudding deshooting, deblossoming etc) staking and netting, photoperiod regulation. 4.1, 4.2, 4.3. 4.4, 4.5, 4.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 510.CO 5: Acquire skills on microclimate management, production management.	**SO5.1** **SO5.2** **SO5.3** **SO5.4** **SO5.5**	5.1. Post harvest handling packaging methods. 5.2. Economic of cultivation, project preparation 5.3. Project financing guidelines 5.4. Visit to commercial green house	**Unit-5.0** Automation and standerds: automation in green house sensors solar green house, retracable green house, GAP/flower labels, export standerds, EXIM policy APEDA regulations for export, non – tariff barriers. 5.1, 5.2, 5.3. 5.4, 5.5.	As mentioned in page number ……

Course Outcomes:

CO1 This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.

CO2 It can be used to find the best solution to any problem be it simple or complex.

CO3 Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.

CO4 To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.

CO5 Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.

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)	STAT-502	Statistical Methods for Applied Science	2	01	02	01	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

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment	Total Marks
			Class/Home Assignment 1 number 5 marks each (CA)	Class Test 2 (2 best out) 15 marks each (CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT+PA+AT)	(ESA)	(PRA+ESA)
PCC	STAT-502	Statistical Methods for Applied Science	5	30	10	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.

STAT-502.1 Know the applications of Statistics and learn and apply these techniques in the agriculture field.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	2
SW	1
SL	1
Total	10

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Apply laws of probability to concrete problems. **SO1.2** Perform statistical inference in several circumstances and interpret the results in an applied context. **SO1.3** Communicate concepts in probability and statistics using both technical and non-technical language**.** **SO1.4** Use a statistical software package for computations with data,	1. To impart knowledge on Statistical concepts like Exploratory data analysis.	**Unit-1.** Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation. **1.1**. Box-plot **1.2** Descriptive statistics **1.3** Exploratory data analysis **1.4** Theory of probability. **1.5** Random variable **1.6**Mathematical expectation	1. Prepare the assignment on Random variable and mathematical expectation.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Random variable and mathematical expectation.

b. Mini Project: -

c. Other Activities (Specify):

STAT-502.2 Find the best solution to any problem be it simple or complex.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	8
SW	1
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Recognize the binomial probability distribution and apply it appropriately. **SO2.2** Recognize the Poisson probability distribution and apply it appropriately. **SO2.3** Recognize and understand discrete probability distribution functions, in general. **SO2.4** Recognize the standard normal probability distribution and apply it appropriately. **SO2.5** Compare normal probabilities by converting to the standard normal distribution.	1- Fitting of Binomial distributions. 2- Fitting of Poisson distributions. 3- Fitting of Negative Binomial distributions. 4- Fitting of Normal distributions.	**Unit-2** Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions. **1.1** Discrete and continuous probability distributions **1.2** Binomial, Poisson, Negative Binomial **1.3**. Normal distribution, Beta and Gamma distributions and their applications **1.4** Concept of sampling distribution: chi-square, *t* and *F* distributions. **1.5** Tests of significance based on Normal, chi-square. **1.6** Tests of significance based on *t* and *F* distributions.	1. Prepare the assignment on Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Simple Problems Based on Probability. Binomial & Poisson Distributions.

STAT-502.3 Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	6
SW	1
SL	1
Total	14

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Create and analyse scatter plots. **SO3.2** Discuss basic ideas of linear regression and correlation. **SO3.3** Create and interpret a line of best fit. **SO3.4** Calculate and interpret the correlation coefficient.	1- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F. 2- Large sample tests, testing of hypothesis based on exact sampling distributions ~t-test. 3- Large sample tests, testing of hypothesis based on exact sampling distributions ~F- test.	**Unit-3** Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. **1.1**. Definition of Correlation **1.2** Types of Correlation **1.3**. Scatter Diagram **1.4**. Karl Pearson's Coefficient of Correlation **1.5** Definition of Regression. **1.6**. Linear Regression Equations	1. Prepare the assignment on Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

STAT-502.4 understand the process of hypothesis testing and its significance. Testing of hypothesis using non-Parametric tests like Median test, runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.

Approximate Hours

Item	Appx Hrs.
CI	6
LI	8
SW	1
SL	1
Total	16

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1 Conduct and interpret hypothesis tests for a single population mean, population standard deviation known. **SO4.2** Conduct and interpret hypothesis tests for a single population mean, population standard deviation unknown. **SO4.3** Describe hypothesis testing in general and in practice **SO4.4** Interpret the chi-square probability distribution as the sample size changes. **SO4.5** Conduct and interpret chi-square goodness-of-fit hypothesis tests.	1 - Confidence interval estimation and 2- Correlation analysis 3 - Regression analysis 4 - Fitting of Linear and Quadratic Model.	**Unit-4** Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table. **1.1** Introduction to Test of Significance **1.2** One sample **1.3** Two sample test t for Means **1.4** Definition of Chi-Square **1.5** Application of Chi-square test **1.6** Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table	1. Prepare the assignment on Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table

STAT-502 CO-5 Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.

Approximate Hours

Item	Appx Hrs.
CI	6
LI	6
SW	1
SL	2
Total	15

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO5.1 Recognize and differentiate between key terms. **SO5.2** Apply various types of sampling methods to data collection. **SO5.3** Create and interpret frequency tables.	1- Non-parametric tests. 2- ANOVA: One way 3- ANOVA: Two Way	**Unit-5** Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample. **1.1** Introduction to Analysis of Variance **1.2**. Analysis of One Way Classification **1.3**. Introduction to Sampling Methods **1.4.** Sampling versus Complete Enumeration **1.5** Simple Random Sampling with and without replacement **1.6** Use of Random Number Tables for selection of Simple Random Sample.	1. Prepare the assignment on Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to 2.Sampling Methods, Sampling versus Complete Enumeration.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C l)	Laboratory Lecture (L I)	Sessional Work (SW)	Self-Learning (S l)	Total hour (C l + LI+ SW +S l)
C01: This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.	06	02	01	01	10
C02: It can be used to find the best solution to any problem be it simple or complex.	06	08	01	01	16
C03: Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.	06	06	01	01	14
C04: To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.	06	08	01	01	16
C05: Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.	06	06	01	02	15
Total Hours	**30**	**30**	**05**	**06**	**71**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit title	Marks Distribution			Total Marks
		R	U	A	
CO-1	This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.	02	02	02	06
CO-2	It can be used to find the best solution to any problem be it simple or complex.	02	03	03	08
CO-3	Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.	02	04	04	10
CO-4	To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.	03	04	05	12
CO-5	Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.	04	05	05	14
	Total	13	18	19	50

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

The end of semester assessment for Statistical Methods for Applied 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, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

S. No.	**Title**	**Author**	**Publisher**	**Edition &** Year
01	An Outline of Statistical Theory	Goon AM, Gupta MK &Dasgupta B.	The World Press	1977 1st adition
02	Fundamentals of Statistics	Goon AM, Gupta MK &Dasgupta B	The World Press	1983. First edition
03	Introduction to Mathematical Statistics	Hoel PG	John Wiley	05th Edition 1971
04	An Introduction to Multivariate Statistical Analysis	T.W. Anderson	John Wiley.	3rd Edition 2009
05	Introduction to Mathematical Statistics	Robert V. Hogg, Joseph W. McKean, Allen T. Craig	Hogg	7th Edition 2012

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8. Mr. Navneet Raj Rathore, Teaching Associate, Department of Agricultural Economics, FAST

Cos, POs and PSOs Mapping
Course Code: STAT-502
Course Title: - Statistical Methods for Applied Science

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of micrcolimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
STAT-502.1 This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.	1	2	3	1	1	1	1	1	1	1	2	3	1	3	2	1	1	1
STAT-502.2 It	1	1	3	1	2	1	1	1	2	3	2	1	1	1	1	1	1	1

can be used to find the best solution to any problem be it simple or complex.																		
STAT-502.3 Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.	3	1	3	2	1	1	1	1	1	2	1	1	3	1	1	1	1	1
STAT-502.4 To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data	3	1	2	3	1	1	1	2	3	1	2	3	2	1	1	1	1	1
STAT-502.5	3	3	2	3	2	1	1	2	2	2	2	2	3	1	1	1	1	1

Apply the different sampling methods for designing and selecting a sample from a population . Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.																		

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Statistical Methods for Applied Science

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT-502.CO 1: This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**	1.1. To impart knowledge on Statistical concepts like Exploratory data analysis.	**Unit-1.0** Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation. 1.1, 1.2, 1.3. 1.4, 1.5, 1.6	As mentioned in page number ……..
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT-502.CO 2: It can be used to find the best solution to any problem be it simple or complex.	**SO2.1** **SO2.2** **SO2.3** **SO2.4** **SO2.5**	2.1. Fitting of Binomial distributions. 2.2. Fitting of Poisson distributions. 2.3. Fitting of Negative Binomial distributions 2.4. Fitting of Normal distributions.	**Unit-2.0 –** Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	As mentioned in page number ……..
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7,	STAT-502.CO 3: Concept of correlation, various correlation	**SO3.1**	3.1. Large sample tests, testing of	**Unit-3.0** Definition of Correlation, Scatter	As mentioned in page

8, 9, 10, 11	coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.	**SO3.2** **SO3.3** **SO3.4**	hypothesis based on exact sampling distributions ~ chi square, t and F. 3.2. Large sample tests, testing of hypothesis based on exact sampling distributions ~ t-test. 3.3. Large sample tests, testing of hypothesis based on exact sampling distributions ~ F-test	Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	number ……..
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT-502.CO 4: To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5**	4.1.Confidence interval estimation and. 4.2. Correlation analysis. 4.3. Regression analysis. 4.4. Fitting of Linear and Quadratic Model.	**Unit-4.0** Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2×2 Contingency Table. 4.1, 4.2, 4.3. 4.4, 4.5, 4.6	As mentioned in page number ……..
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT-502.CO 5: Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.	**SO5.1** **SO5.2** **SO5.3**	5.1. Non-parametric tests. 5.2. ANOVA: One way 5.3. ANOVA: Two Way	**Unit-5.0** Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample. 5.1, 5.2, 5.3. 5.4, 5.5, 5.6.	As mentioned in page number ……..

Semester- I

Course Code: VSC 510

Course Title: **Systematic of vegetable crops.**

Pre- requisite: Student should have basic knowledge on morphological, cytological and molecular taxonomy of Vegetable crops.
Rationale: Systematic is fundamental to our understanding of the world as it provides basis for understanding the patterns of diversity on earth. vegetables systematic is the science of botanical diversity of vegetable crop on earth including variations from the level of genus within an individual's populations and species. The aim of systematic is to discover all the branches of the level of life towards evolutionary changes occurring along these branches and describe all the species on earth and level of crop diversity.

Course Outcomes:

VSC510.1: To understand basic significance of systematics and crop diversity. Principles and methods of classification including ICBN.

VSC510.2: Students will have the ability to apply the knowledge gained about origin, evolution and distribution of vegetable crops.

VSC510.3: Student will be able to Understand Botanical and Morphological description of vegetable crops.

VSC510.4: Understanding on Cytological levels of vegetable crops.

VSC510.5: Idea on Molecular markers in various Vegetable crops.

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)	VSC 510	Systematic of vegetable crops.	1	1	1	1	4	1+1=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.

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

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 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
	VSC 510	Systematic of vegetable crops.	15	30	0	0	5	50	50	100

VSC510.1: Apply the knowledge of Significance of systematic and crop diversity in relation to vegetable crops.

Approximate Hours

Item	App X Hrs
Cl	03
LI	04
SW	02
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand significance of systematic and crop diversity in vegetable crops. **SO1.2**Ability to understand the Principles and methods of Classification of vegetable crops. **SO1.3**Understand about the Salient features of International code for nomenclature of vegetable crops.	Unit 1.0 Principles and methods of classification of vegetable crops. 1.1 Identification of vegetable crops and their species. 1.2 To know the Principles and methods of classification of vegetable crops.	**Unit-1.0 Significance of systematic and crop diversity in vegetable crops, Principles and methods of classification and Salient features of International code for nomenclature of vegetable crops.** 1.1 Meaning of Systematic and crop diversity, it's significance. 1.2Principles and methods of classification of vegetable crops. 1.3 Salient features of International code for nomenclature of vegetable crops.	1.Principles of Classification. 2.Different methods of classification of vegetable crops.

SW-1Suggested Sessional Work (SW):

a. Assignments:

i. Preparation of herbarium (Using seeds and leaves of vegetable crops.

b. Mini Project:

i. Prepare chart of botanical classification of Vegetable crops.

Other Activities (Specify):

VSC510.2: Ability to understand about Origin and distribution of various vegetable crops.

Approximate Hours

Item	App X Hrs
Cl	03
LI	06
SW	02
SL	02
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Understand the Origin of vegetable crops. **SO2.2** History of various vegetable crops. **SO2.3** Understand the evolution of vegetable crops. **SO2.4** Understand about the distribution of various vegetable crops.	2.1 Practices of grouping Vegetable crops originated from same country. 2.2Practice of grouping Vegetable crops originated from different countries. 2.3 Practices of grouping Vegetable crops originated from India.	**Unit-2Origin and Evolution**. 2.1 Learn the Origin of vegetable crops. 2.2History of vegetable crops. 2.3 Evolution and distribution of various vegetable crops.	1.Understand the vegetable crops originated from India. 2.Understand about distribution of various vegetable crops.

SW-2 Suggested Seasonal Work (SW):

a Assignments:

1 Origin, History and distribution of various vegetable crops.

B Mini Project

1. Prepare chart of vegetable crops originated from India.

c. Other Activities (Specify)

VSC510.3: Understand the Botanical and Morphological descriptions of all parts of vegetables.

Approximate Hours

Item	App X Hrs
Cl	03
LI	02
SW	01
SL	02
Total	08

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 Understand Botanical description of all types of vegetable crops. **SO3.2**Determine the Morphological keys to identify different vegetables. **SO3.3** Understand Floral biology of different vegetables.	1.Preparation of keys to the species and varieties.	**Unit-3 Botanical and Morphological descriptions.** 3.1 Botanical description of families, genera and species covering various tropical, subtropical and temperate vegetables. 3.2 Morphological keys to identify important families, floral biology, floral formula and diagram. 3.3 Morphological descriptions of all types of vegetable.	1.Importance of Floral biology, Formula and diagram. 2.Learn Botanical description of important vegetable crops.

SW-3 Suggested Sessional Work (SW):

a Assignments:

1. Preparation of Chart showing Floral formula and diagram of various vegetable crops.

b Mini Project

c Other Activities(Specify)

VSC510.4: Understand the concepts of cytology of vegetables.

Approximate Hours

Item	App X Hrs
Cl	03
LI	02
SW	03
SL	02
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 Definition of cytology in relation to vegetable crops. **SO4.2** Importance of Cytology as important keys in vegetable crops. **SO4.3** Cytological levels of various vegetable crops with descriptive keys.	1. Survey, collection of allied species and genera locally available in vegetable crops.	**Unit-4.0: Cytology of vegetable crops.** 4.1 Introduction about Cytology of vegetable crops. 4.2 Importance of Cytology in vegetable crops. 4.3 Cytology as important descriptive keys in identifying the vegetable crops.	**1**. Importance of cytology in relation to vegetable crops. 2. Various descriptive keys in cytology of vegetables.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Role of cytology in advanced Vegetable production.

b. Mini Projects:

i. Preparation of chart showing various Cytological levels in vegetable crops.

e. Other Activities (Specify):

i. Visit to Commercial Nursery and orchard.

VSC510.5: Understand the concept of Molecular markers in relation to vegetable crops.

Approximate Hours

Item	**App X Hrs**
Cl	03
LI	04
SW	02
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5.1 Understand the importance of molecular markers in evolution of vegetable crops. **SO5.2**Methods of Molecular markers in vegetable crops. **SO5.3**Understand the molecular markers in vegetable characterization.	5.1 Practices of Molecular markers. 5.2 Practice of molecular markers in vegetable taxonomy.	**Unit5: Molecular markers in vegetable crops.** 1. Use/Importance of Molecular markers in evolution of vegetable crops. 2. Molecular markers as an aid in characterization in vegetable crops. 3. Molecular markers in vegetable taxonomy.	1. Identify different molecular markers. 2. Importance of molecular markers in vegetable crops.

SW-5 Suggested Sessional Work (SW):

a Assignments:

i. Methods of herbarium preparation.

b Mini Projects:

1 Prepare chart showing importance of molecular markers.

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)
VSC510.1: To understand basic knowledge of significance of systematics, Principles and Methods of classification including ICBN.	7	2	2	11
VSC510.2: Students will have the ability to apply the knowledge gained about Origin, History, evolution and distribution of vegetable crops.	9	2	2	13
VSC510.3: Student will be able to Understand Botanical and Morphological description of vegetable crops.	5	1	2	8
VSC510.4: Understanding on Cytological levels of vegetable crops.	5	3	2	10
VSV510.5: Ideas on Molecular markers in various Vegetable crops.	7	2	2	11

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	**Unit Titles**	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO 1	Significance of systematics and Crop diversity, Principles and methods of classification including ICBN. 1.1 Identification of vegetable crops and their species. 1.2 To know the Principles and methods of classification of vegetable crops.	3	3	4	10
CO 2	Origin, history, evolution and distribution of vegetable crops. 2.1 Practices of grouping Vegetable crops originated from same country. 2.2Practice of grouping Vegetable crops originated from different countries. 2.3 Practices of grouping Vegetable crops originated from India.	4	3	3	10
CO 3	Botanical and Morphological description of vegetable crops. 3.1 Preparation of keys to the species and varieties.	0	0	10	10
CO 4	Cytological levels of vegetable crops. Survey, collection of allied species and genera locally available in vegetable crops.	4	2	4	10
CO 5	Molecular markers in various Vegetable crops. 5.1 Practices of Molecular markers. 5.2 Practice of molecular markers in vegetable taxonomy.	5	3	2	10

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

The end of semester assessment for Systematics of Vegetable 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
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	Angiosperms - Systematics and life cycle.	Chopra, GL	Oxford University Press.	1968.
2	A class book of Botany.	Dutta, S. Nagin.	Oxford University Press.	1968.
3	Genetics and breeding of vegetables. (Revised)	Peter, KV and T, Pradeepkumar.	ICAR Publications.	2008.
4	Handbook of vegetables.	Peter, KV and Hazra, P (Eds.)	Stadium Press LLC.	2012.
5	Handbook of vegetables volume II	Peter, KV and Hazra, P	Stadium Press LLC.	2015.
6	Handbook of vegetables volume III.	Peter, KV and Hazra, P	Stadium Press LLC.	2015.
7	Evolution of crop plants.	Simmonds, NW and J, Smartt.	John Wiley and sons.	1995.
8	Glossary for Horticultural crops.	Blackwell, Wiley and J, Soule.	John Wiley and sons.	1985.

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Cos, POs and PSOs Mapping
Course Code: VSC 510
Course Title: - Systematic of vegetable crops

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 510.1 To understand basic significance of systematics and crop diversity.Principles and methods of classification including ICBN.	3	3	2	1	1	1	1	1	3	1	2	3	3	3	1	1	1	1

VSC 510.2 Students will have the ability to apply the knowledge gained about origin, evolution and distribution of vegetable crops.	3	3	2	1	2	1	1	1	3	2	2	1	2	2	1	1	1	1
VSC 510.3 Student will be able to Understand Botanical and Morphological description of vegetable crops. crop management.	3	3	2	2	1	1	1	2	3	2	1	1	3	1	1	1	1	1
VSC 510.4 Understanding on Cytological levels of vegetable crops. crop management	3	3	1	3	2	1	1	2	3	1	2	3	2	2	1	1	1	1
VSC 510.5 Idea on Molecular markers in various Vegetable crops.	3	3	1	2	2	1	1	2	3	1	3	2	3	1	1	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Systematic of vegetable crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 510.CO 1 To understand basic significance of systematics and crop diversity. Principles and methods of classification including ICBN.	**SO1.1 SO1.2 SO1.3**	1.1 Identification of vegetable crops and their species. 1.2 To know the Principles and methods of classification of vegetable crops.	**Unit-1.0** Significance of systematic and crop diversity in vegetable crops, Principles and methods of classification and Salient features of International code for nomenclature of vegetable crops. 1.1, 1.2, 1.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 510.CO 2: Students will have the ability to apply the knowledge gained about origin, evolution and distribution of vegetable crops. .	**SO2.1 SO2.2 SO2.3 SO2.4**	**2.1** Practices of grouping Vegetable crops originated from same country. 2.2Practice of grouping Vegetable crops originated from different countries. 2.3 Practices of grouping Vegetable crops originated from India	**Unit-2.0 –** Origin and Evolution. 2.1, 2.2, 2.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 510.CO 3: Student will be able to Understand Botanical and Morphological description of vegetable crops.	**SO3.1 SO3.2 SO3.3**	3.1. Preparation of keys to the species and varieties	**Unit-3.0** Botanical and Morphological descriptions. 3.1, 3.2, 3.3	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 510.CO 4: Understanding on Cytological levels of vegetable crops.	**SO4.1 SO4.2 SO4.3**	4.1. Survey, collection of allied species and genera locally available in vegetable crops	**Unit-4.0** Cytology of vegetable crops. 4.1, 4.2, 4.3	As mentioned in page number …
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 510.CO 5: Idea on Molecular markers in various Vegetable crops.	**SO5.1 SO5.2 SO5.3**	5.1 Practices of Molecular markers. 5.2 Practice of molecular markers in vegetable taxonomy.5.4. Visit to commercial green house	**Unit-5.0** Molecular markers in vegetable crops. 5.1, 5.2, 5.3	As mentioned in page number ……

Semester- I

Course Code: **FLS 508**

Course Title: **Turfgrass Management**

Pre- requisite: To understand the science, principles and management of turf grasses

Rationale: Turf grass management deals with establishment and maintenance of different turf grasses for aesthetic, recreational and sports purposes. The course deals with basic types, requirement of turf grasses, management and development of turf for different purposes.

Course Outcomes:

FLS 508.1: Student will employ the knowledge about the prospects and basic requirements of turf industry

FLS 508.2: Student will recall the prospects and basic requirements of turf industry. Gain an understanding of the physiological, genetic, and environmental factors affecting turfgrass growth and development**.**

FLS 508.3: Student will recall the major cultural practices of mowing, irrigation and fertilization for turfgrasses, and the supplementary cultural practices of cultivation, topdressing, rolling, use of wetting agents and use of plant growth regulators**.**

FLS 508.4: Understanding on Establishment and maintenance of turfs for playgrounds, residential and public parks, turfing of Govt. and Corporate office gardens

FLS 508.5: Demonstrate competencies in the application of technical practices, processes, procedures, and skills necessary to meet the expectations of turf industries

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)	FLA 508	Turfgrass 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

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 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
PCC	FLA 508	Turfgrass Management	15	30	0	0	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.

FLA 508.1: Student will employ the knowledge about the prospects and basic requirements of turf industry

Approximate Hours

Item	Approximate Hours
CI	6
LI	0
SW	2
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO 1.1. Understand the scope and importance of turf industry **SO 1.2.** Ability to know the basic requirement of turf industry **SO 1.3.** Student will able to examine the various criteria for evaluation of turf quality **SO 1.4.** Develop required entrepreneurial acumen.		**Unit-1.0** Prospects and basic requirement: History, present status and prospects of turf industry; basic requirements, site selection and evaluation, concepts of quality of soil pertaining to turf grass establishment, criteria for evaluation of turf quality. 1.1History of turf industry 1.2 Status and prospects of turf industry 1.3 Basic requirements 1.4 Site selection and evaluation 1.5 concepts of quality of soil pertaining to turf grass establishment 1.6 criteria for evaluation of turf quality	1. Scope and importance of turf grass management in India

SW-1 Suggested Sessional Work (SW):

j. Assignments:

vii. Prepare site analysis profarma for establishment of turf

k. Mini Project:

v. Prepare chronological chart of turf industry history of world

l. Other Activities (Specify):

FLS 508.2: Student will recall the prospects and basic requirements of turf industry. Gain an understanding of the physiological, genetic, and environmental factors affecting turfgrass growth and development.

Approximate Hours

Item	Approximate Hours
CI	04
LI	01
SW	02
SL	02
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Demonstrate the ability to identify, establish and maintain various species of fine turfgrasses, as well as ornamentals and native plants **SO 2.2.** Identify the various parts and characteristics of turf plants that facilitate the correct identification of grass species**.** **SO 2.3.** Determine the correct species, mix, or blend of turf plants for a variety of use environmental or aesthetic conditions	1.Identification of turf grasses	**Unit-2.** Types of turf grasses: Types, species, varieties, important breeders, grasses for different locations and conditions and their compatible groupings as per climatic conditions; Turfing for roof gardens. 2.1. Anatomy of turf grasses 2.2 Species and types of turf grasses 2.3Grasses for different locations and conditions and their compatible groupings as per climatic conditions 2.4 Turfing for roof gardens.	**5.** Turf species and varieties **6.** Classification of turf

SW-2 Suggested Sessional Work (SW):

a. Assignments:

6. Prepare a chart of different cool and warm season turf

b. Mini Project:

2. Collect different turf species/varieties and make a herbarium

cii. Other Activities (Specify):

FLS 508.3: Student will recall the major cultural practices of mowing, irrigation and fertilization for turfgrasses, and the supplementary cultural practices of cultivation, topdressing, rolling, use of wetting agents and use of plant growth regulators.

Approximate Hours

Item	Approximate Hours
CI	14
LI	16
SW	02
SL	02
Total	34

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1. Prepare responsible, realistic, and reliable cultural and maintenance programs for maintenance at high end turfgrass facilities while being a steward of the environment **SO 3.2.** Identify and describe the various methods of installation and establishment of turf**.** **SO 3.3.** Understand the special cultural practices applied in management of turf **SO 3.4.** Able to identify the causes of biotic and abiotic stresses in turf **SO 3.5.** Understand the role of PGR and micronutrients in growth and development of turf	1.Soil preparation for turfing 2. Turf establishment methods 3. Drainage in turf 4. Layout of macro and micro irrigation systems 5. Water and nutrient management 6. Special practices – mowing, raking, rolling, soil top dressing, weed	**Unit 3** Operations and management: Preparatory operations; Turf establishment methods such as seeding, sprigging/ dibbling, plugging, sodding/ turfing, turf plastering, instant turfing (portable), hydroseeding, synthetic turfing. Turf management – Irrigation, drainage, nutrition, and special practices like aerating, rolling, coring, dethatching, verticutting, soil top dressing, use of plant growth regulators and micronutrients, Turf mowing – mowing equipments, techniques to Minimize wear and compaction, weed control, biotic and abiotic stress management in turfs, standards for turf, use of recycled water, etc. **3.1.** Turf establishment methods such as seeding, sprigging/ dibbling, plugging, sodding/ turfing, turf plastering, instant turfing (portable) **3.2.** Hydroseeding, synthetic turfing **3.3.** Irrigation management in turf	1. Astroturfing 2. Special practices in turf

	management 7. Biotic and abiotic stress management 8. Rejuvenation of lawns	**3.**4. Drainage practices in turf **3.5.** Nutrition management in turf **3.6.** Special practices like aerating, rolling, coring, dethatching, verticutting, soil top dressing **3.7.** Use of plant growth regulators and micronutrients in turf **3.8.** Turf mowing – mowing equipments. 3.9 Techniques to Minimize wear and compaction 3.10. Weed control in turf 3.11. Biotic stress management in turf 3.12 Abiotic stress management in turf 3.13 Standards for turf 3.14 Use of recycled water	

SW-3 Suggested Sessional Work (SW):

g. Assignments:

Management of biotic and abiotic stress in turf

h. Mini Project:

i. Project preparation for turf establishment

i. Other Activities (Specify):

FLS 508.4: Understanding on Establishment and maintenance of turfs for playgrounds, residential and public parks, turfing of Govt. and Corporate office gardens

Approximate Hours

Item	Approximate Hours
CI	04
LI	02
SW	02
SL	01
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 4.1. Understand the uses of tuf in different areas **SO 4.2.** Differentiate between similar, commonly used cool weather grasses used in residential, sport, and golf applications**.** **SO 4.3.** Able to establish and maintain the turf in residential as well as sports field **SO 4.4.** Understand about the turf colourants	1.Turf economics	**Unit 4.** Making of different sports arenas: Establishment and maintenance of turfs for playgrounds, viz., golf, football, hockey, cricket, tennis, rugby, residential and public parks, turfing of Govt. and Corporate office gardens, event specific preparation, turf colourants 4.1 Establishment and maintenance of turfs for golf and football playground. 4.2 Establishment and maintenance of turfs for hockey and cricket playground. 4.3 Establishment and maintenance of turfs for tennis and rugby playground. 4.4 Turfing of Govt. and Corporate office gardens, event specific preparation, turf colourants	1.Establishment and maintenance of turfs for different athletic field

SW-4 Suggested Sessional Work (SW):

g. Assignments:

i. Enlist the suitable varieties of turf for different athletic fields.

h. Mini Project:

i. Other Activities (Specify):

i. Visit to parks, model cricket grounds and golf courses, airports, corporates, Govt. organizations

FLS 508.5: Demonstrate competencies in the application of technical practices, processes, procedures, and skills necessary to meet the expectations of turf industries

Approximate Hours

Item	Approximate Hours
CI	02
LI	02
SW	01
SL	01
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Able to understand the different tools and equipments used in turf industries **SO5.2** Develop skill about the use o different turf industry related gadgets and machines.	1. Identification of turf machinery	**Unit 5:** Automation: Exposure to different tools, gadgets, machinery used in turf industry 5.1 Exposure to different tools, gadgets, machinery used in turf industry 5.2 Operation and maintenance of different tools, gadgets, machinery used in turf industry	1. Operation and limitation of different tools and equipments

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Enlist the different tools, gadgets, machinery used in turf industry

b. Mini Project:

d. 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)
FLS508.1: Student will employ the knowledge about the prospects and basic requirements of turf industry	12	2	1	15
FLS508.2: Student will recall the prospects and basic requirements of turf industry. Gain an understanding of the physiological, genetic, and environmental factors affecting turfgrass growth and development**.**	5	2	2	9
FLS508.3: Student will recall the major cultural practices of mowing, irrigation and fertilization for turfgrasses, and the supplementary cultural practices of cultivation, topdressing, rolling, use of wetting agents and use of plant growth regulators**.**	20	2	2	34
FLS508.4: Understanding on Establishment and maintenance of turfs for playgrounds, residential and public parks, turfing of Govt. and Corporate office gardens	6	2	1	9
FLS508.5: Demonstrate competencies in the application of technical practices, processes, procedures, and skills necessary to meet the expectations of turf industries	4	1	1	6

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Prospects and basic requirement: History, present status and prospects of turf industry; basic requirements, site selection and evaluation, concepts of quality of soil pertaining to turf grass establishment, criteria for evaluation of turf quality.	2	6	2	10
CO 2	Types of turf grasses: Types, species, varieties, important breeders, grasses for different locations and conditions and their compatible groupings as per climatic conditions; Turfing for roof gardens.	5	2	3	10
CO 3	Operations and management: Preparatory operations; Turf establishment methods such as seeding, sprigging/ dibbling, plugging, sodding/ turfing, turf plastering, instant turfing (portable), hydroseeding, synthetic turfing. Turf management – Irrigation, drainage, nutrition, and special practices like aerating, rolling, coring, dethatching, verticutting, soil top dressing, use of plant growth regulators and micronutrients, Turf mowing – mowing equipments, techniques to Minimize wear and compaction, weed control, biotic and abiotic stress management in turfs, standards for turf, use of recycled water, etc.	4	4	2	10
CO 4	Making of different sports arenas: Establishment and maintenance of turfs for playgrounds, viz., golf, football, hockey, cricket, tennis, rugby, residential and public parks, turfing of Govt. and Corporate office gardens, event specific preparation, turf colourants	3	4	3	10
CO 5	Automation: Exposure to different tools, gadgets, machinery used in turf industry	2	4	4	10
	Total	**16**	**20**	**14**	**50**

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

The end of semester assessment for **Turfgrass 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. Hands on training of different techniques
6. Exposure visits
7. Demonstration
8. Flip classes
9. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Turf grass Management	Turgeon AJ.	Reston Publication	1980
2	Turf grass Management	Chawla SL, Patil S, Patel MA, Patel RB and Patel RM	NAU, Navsari	2013
3	Turf grass Science and Management	Emmons R.	Cengage Learning Publication	2007
4	International Turf Management Handbook	Aldous D	CRC Press	1999
5	Fundamentals of Turf grass Management	Nick-Christians	Wiley Publication	2011

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Cos, POs and PSOs Mapping
Course Code: FLS 508
Course Title: - Turfgrass Management

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
FLS 508.1 Student will employ the knowledge about the prospects and basic requirements of turf industry. .	3	1	2	1	1	1	1	1	2	1	2	2	3	2	3	1	1	1
FLS	3	1	2	1	2	1	1	1	2	2	2	1	2	2	3	1	1	1

508.2 Student will recall the prospects and basic requirements of turf industry. Gain an understanding of the physiological, genetic, and environmental factors affecting turfgrass growth and development.																		
FLS 508.3 Student will recall the major cultural practices of mowing, irrigation and fertilization for turfgrasses, and the supplementary cultural practices of cultivation, topdressing, rolling, use of wetting agents and use of plant growth	2	2	3	2	1	1	1	2	2	2	1	1	2	1	3	1	1	1

regulators.																		
FLS 508.4 Understanding on Establishment and maintenance of turfs for playgrounds, residential and public parks, turfing of Govt. and Corporate office gardens	3	1	1	1	2	1	1	2	1	1	2	2	2	2	3	1	1	1
FLS 508.5 Demonstrate competencies in the application of technical practices, processes, procedures, and skills necessary to meet the expectations of turf industries.	3	2	1	2	2	1	1	2	3	1	1	2	2	1	3	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Turfgrass Management

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 508.CO 1: Student will employ the knowledge about the prospects and basic requirements of turf industry.	**SO1.1 SO1.2 SO1.3 SO1.4**	1.1 Laboratory exercises in probability and chi-square. 1.2 To study about demonstration of genetic principles using laboratory organisms. 1.3 To study about Chromosome mapping using three-point test cross.	**Unit-1.0** Prospects and basic requirement: History, present status and prospects of turf industry; basic requirements, site selection and evaluation, concepts of quality of soil pertaining to turf grass establishment, criteria for evaluation of turf quality. 1.1, 1.2, 1.3. 1.4, 1.5, 1.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 508.CO 2: Student will recall the prospects and basic requirements of turf industry. Gain an understanding of the physiological, genetic, and environmental factors affecting turfgrass growth and development. .	**SO2.1 SO2.2 SO2.3**	**2.1** Identification of turf grasses.	**Unit-2.0 –** Types of turf grasses: Types, species, varieties, important breeders, grasses for different locations and conditions and their compatible groupings as per climatic conditions; Turfing for roof gardens. 2.1, 2.2, 2.3. 2.4	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 508.CO 3: Student will recall the major cultural practices of mowing, irrigation and fertilization for turfgrasses, and the supplementary cultural practices of cultivation, topdressing, rolling, use of wetting agents and use of plant growth regulators.	**SO3.1 SO3.2 SO3.3 SO3.4 SO3.5**	3.1. Soil preparation for turfing. 3.2. Turf establishment methods. 3.3. Drainage in turf. 3.4. Layout of macro and micro irrigation systems. 3.5. Water and nutrient management. 3.6. Special practices – mowing, raking, rolling, soil top dressing, weed management. 3.7. Biotic and abiotic stress management. 3.8. Rejuvenation of lawns	**Unit-3.0** Operations and management: Preparatory operations; Turf establishment methods such as seeding, sprigging/ dibbling, plugging, sodding/ turfing, turf plastering, instant turfing (portable), hydroseeding, synthetic turfing. Turf management – Irrigation, drainage, nutrition, and special practices like aerating, rolling, coring, dethatching, verticutting, soil top dressing, use of plant growth regulators and micronutrients, Turf mowing – mowing equipments, techniques to Minimize wear and compaction, weed control, biotic and abiotic stress management in turfs, standards for turf, use of recycled water, etc. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 508.CO 4: Understanding on Establishment and maintenance of turfs	**SO4.1 SO4.2 SO4.3 SO4.4**	4.1. Turf economics.	**Unit-4.0** Making of different sports arenas: Establishment and maintenance of turfs for playgrounds, viz., golf,	As mentioned in page number

	for playgrounds, residential and public parks, turfing of Govt. and Corporate office gardens.			football, hockey, cricket, tennis, rugby, residential and public parks, turfing of Govt. and Corporate office gardens, event specific preparation, turf colourants. 4.1, 4.2, 4.3, 4.4	……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 508.CO 5: Demonstrate competencies in the application of technical practices, processes, procedures, and skills necessary to meet the expectations of turf industries.	**SO5.1** **SO5.2**	5.1 Identification of turf machinery.	**Unit-5.0** Automation: Exposure to different tools, gadgets, machinery used in turf industry. 5.1, 5.2.	As mentioned in page number ……

Semester- II

Course Code: **PGS 502**

Course Title: **Intellectual Property and Its Management in Agriculture**

Pre- requisite: To teach the physiology of Intellectual Property and Its Management in Agriculture

Rationale: The main objective of this course is to equip students and stakeholders with

knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge based economy.

Course outcomes:

PGS 502.1: Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.

PGS 502.2: Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.

PGS 502.3: Students will be able to understand Research Collaboration Agreement, License agreement

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 (PGS)	PGS 502	Intellectual Property and Its Management in Agriculture	1	0	1	1	3	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

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment	Total Marks
			Class/Home Assignment1 number 5 marks each (CA)	Class Test2 (2 best out) 20 marks each (CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT+PA+AT)	(ESA)	(PRA+ESA)
PGS	PGS 502	Intellectual Property and Its Management in Agriculture	5	40	0	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.

PGS 502.1: Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.

Approximate Hours

Item	App X Hrs
Cl	04
LI	0
SW	01
SL	02
Total	07

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Student will understand the Historical perspectives and need for the introduction of Intellectual Property Right. **SO1.2** Student will recognize the TRIPs and various provisions in TRIPS Agreement. **SO1.3** Student will understand different Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs		**Unit-1.0** Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs. **1.1** Historical perspectives and need for the introduction of Intellectual Property Right regime. **1.2** TRIPs and various provisions in TRIPS Agreement. **1.3** Intellectual Property and Intellectual Property Rights (IPR). **1.4** Benefits of securing IPRs.	3. Role of IPR and its benefits. 4. Role of TRIPS and its benefits

SW-1 Suggested Sessional Work (SW):

b. Assignments:

I. Preparation of file and write the role of IPR and TRIPS and their purpose.

PGS 502.2: Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.

Approximate Hours

Item	App X Hrs
Cl	06
LI	0
SW	02
SL	03
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self -Learning (SL)
SO2.1 Students will understand the Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout **SO2.2**Students will understand the trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection. **SO2.3** Students will identify the role of Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.		**Unit-2** Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. **2.1** Indian Legislations for the protection of various types of Intellectual Properties. **2.2** Fundamentals of patents, copyrights, geographical indications, designs and layout. **2.3** trade secrets and traditional knowledge and trademarks. **2.4** protection of plant varieties and farmers' rights and biodiversity protection. **2.5** Protectable subject matters, protection in biotechnology. **2.6** protection of other biological materials, ownership and period of protection.	1. Basic Indian Legislature. 2. Plant varieties and farmers' rights act (2001). 3. Biodiversity act (2002).

SW-2 Suggested Seasonal Work (SW):

Assignments:

I. Note on Plant varieties and farmers' rights act (2001).

II. Note on Biodiversity act (2002).

PGS 502.3: Students will be able to understand Research Collaboration Agreement, License agreement.

Approximate Hours

Item	App X Hrs
Cl	05
LI	0
SW	02
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Students will identify the National Biodiversity protection initiatives and Convention on Biological Diversity. **SO3.2** Students will understand the International Treaty on Plant Genetic Resources for Food and Agriculture and Licensing of technologies. **SO3.2** Students will understand the Material transfer agreements, Research collaboration Agreement and License Agreement.		**Unit-3:** National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement. **3.1** National Biodiversity protection initiatives. **3.2** Conventions on Biological Diversity. **3.3** International Treaty on Plant Genetic Resources for Food and Agriculture. **3.4** Licensing of technologies and Material transfer agreements. **3.5** Research collaboration Agreement and License Agreement.	1. Plant Genetic Resources.

SW-3 Suggested Sessional Work (SW):

a. **Assignments**:

i. Note on Plant Genetic Resources.

ii. Note on National Biodiversity protection initiative

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
PGS 502.1: Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.	04	01	02	07
PGS 502.2: Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.	06	02	03	11
PGS 502.3: Students will be able to understand Research collaboration Agreement, License agreement.	05	02	01	08
Total	**15**	**05**	**06**	**26**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs.**	05	03	02	**10**
CO 2	**Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.**	05	02	03	**10**
CO 3	**National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.**	05	03	02	**10**

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

The end of semester assessment for **Intellectual Property and Its Management in Agriculture** 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 organic fields
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	Intellectual Property Rights in Agricultural Biotechnology	• Erbisch FH and Maredia K	CABI.	1998
2	Intellectual Property Rights: Unleashing Knowledge Economy	• Ganguli P	McGraw-Hill.	2001
3	Intellectual Property Rights: Key to New Wealth Generation		NRDC and Aesthetic Technologies.	2001
4	State of Indian Farmer. Vol. V. Technology Generation and IPR Issues	• Ministry of Agriculture, Government of India	Academic Foundation	2004
5	Intellectual Property Rights in Animal Breeding and Genetics	• Rothschild M and Scott N	CABI	2003

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Cos, POs and PSOs Mapping

Course Code: PGS503

Course Title: - Intellectual Property and Its Management in Agriculture

Course Outcomes	**PO 1**	**PO 2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO 7**	**PSO 1**	**PSO2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO6**	**PSO 7**	**PSO 8**	**PSO 9**	**PSO 10**	**PSO 11**
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
PGS 503.1: Students will be able to understand Historical	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	2	1	2

perspectives and need for the introduction of Intellectual Property Right																		
PGS 503.2: Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.	1	1	1	1	1	3	2	1	1	1	1	1	1	1	1	2	1	3
PGS 503.3: Students will be able to understand Research Collaboration Agreement, License agreement	2	2	1	2	1	1	3	1	1	1	2	1	1	1	1	1	2	2

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Intellectual Property and Its Management in Agriculture

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**PGS 503.CO1**: Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right	**SO1.1** **SO1.2** **SO1.3**		**Unit-1.0** Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs. 1.1, 1.2, 1.3	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**PGS 503.CO2:** Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.	**SO2.1** **SO2.2** **SO2.3**		**Unit-2** Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**PGS 503.CO3:** Students will be able to understand Research Collaboration Agreement, License agreement	**SO3.1** **SO3.2** **SO3.3**	8.	**Unit-3:** National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement. 3.1, 3.2, 3.3, 3.4, 3.5	

A K S University
Faculty of Agricultural Science and Technology
Department of Biochemistry and Crop Physiology
Curriculum of M.Sc. (All Branches)

Semester II

Course Code: PGS504

Course Title: Basic Concepts in Laboratory Techniques

Pre requisite: No specific requirements

Rationale: Studying basic laboratory techniques are fundamental for scientific research, ensuring accurate experimentation and data analysis. Mastery of these skills cultivates precision, reproducibility, and safety, forming the cornerstone of scientific inquiry across disciplines and facilitating advancements in knowledge and technology.

Course Outcomes: CO1_PGS504 Student will learn about basic instrumentation, its principles, working and use. They will learn about Making solutions of different concentrations, learn acid base interaction. Also, student will learn about Procedural outline of various experiments. Student will learn about Basics of plant tissue culture and seed viability testing.

Scheme of Studies

Board Of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)					Total Credit (C)
			CI	LI	SW	SL	Total Study Hours	
NC	PGS504	Basic Concepts in Laboratory Techniques	00	2	00	00	2	01

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

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 number3 marks each (CA)	Class Test 2 (2 best out of3) 10 marks each (CT)	Seminar one	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
NC	PGS504	Basic Concepts in Laboratory Techniques							100	100

Course-Curriculum Detailing:

Laboratory techniques are important for any person conducting an experiment. Every procedure needs to be complete with accuracy and precision with proper safety measures. Student will understand the safety and details of working in scientific laboratory. Student will familiarize with various instruments and their principles. Student will practice and visualize common experimental procedures.

PGS504-Basic Concept of Laboratory Techniques

Approximate Hours

Item	Appx Hrs
CI	00
LI	30
SW	00
SL	00
Total	30

Session Outcomes (SOs)	**Laboratory Instructions (LI)**	**Classroom Instructions (CI)**	**Self-Learning (SL)**
SO.L1 Identify safety measures while in Lab SO.L2 Recognize use of glasswares. SO.L3 Discover handling of glasswares. SO.L4 Recognize Drying of solvents/ chemicals; SO.L5 Describe working with chemicals. SO.L6 Describe working with solutions. SO.L7 Articulate the technique of formulating doses of agrochemicals	L1. Safety measures while in Lab; L2. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; L3. Washing, drying and sterilization of glassware; L4. Drying of solvents/ chemicals; L5. Handling of chemical substances; Weighing and preparation of solutions of different strengths and their dilution; L6. Handling techniques of solutions;		

SO.L8 Discover handling techniques of solutions SO.L9 Identify the handling of acid and bases SO.L10 Discover the formulation of buffer and solutions of specific pH. SO.L11 Identify the use of lab instruments SO.L12 Recognize and categorize the media requirements and its types SO.L13 Discover the methods and application of viability of germplasm SO.L14 Illustrate procedure for plant tissue culture SO.L15 Recognize flowering plant by its taxonomical description	L7. Preparation of different agro-chemical doses in field and pot applications; L8. Preparation of solutions of acids; L9. Neutralisation of acid and bases; L10. Preparation of buffers of different strengths and pH values; L11. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing; L12. Preparation of media and methods of sterilization; L13. Seed viability testing, testing of pollen viability; L14. Tissue culture of crop plants; L15. Description of flowering plants in botanical terms in relation to taxonomy		

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class lecture (CL)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+SW+SL)
Basic Concept of Laboratory Techniques	0+30	0	0	30

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
PGS 504 Student will learn about basic instrumentation, its principles, working and use. They will learn about Making solutions of different concentrations, learn acid base interaction. Also, student will learn about Procedural outline of various experiments. Student will learn about Basics of plant tissue culture and seed viability testing	**Basic Concept of Laboratory Techniques**		**30**	**70**	**100**

Suggested Learning Resources:

Sl. No.	Title	Author	Publisher	Edition and Year
01	Laboratory Techniques in Organic Chemistry	Jerry R. Mohrig, David G. Alberg, and Gretchen M. Adams	W. H. Freeman and Company.	2014
02	Biotechnology: Expanding Horizons	B D Singh	Kalyani Publishers	2005

Cos, POs and PSOs Mapping
Course Code: PGS 504
Course Title: - Basic Concepts in Laboratory Techniques

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO 7
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post - harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management
PGS504 Student will learn about basic instrumentation, its principles, working and use. They will learn about Making solutions of differe	1	1	1	1	2	3	2	1	1	1	1	1	1	1

nt concentrations, learn acid base interaction. Also,student will learn about Procedural outline of various experiments. Student will learn about Basics of plant tissue culture and seed viability testing. .														

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Basic Concepts in Laboratory Techniques

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	PGS 504.CO 1 Student will learn about basic instrumentation, its principles, working and use. They will learn about Making solutions of different concentrations, learn acid base interaction. Also, student will learn about Procedural outline of various experiments. Student will learn about Basics of plant tissue culture and seed viability testing.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6** **SO1.7** **SO1.8** **SO1.9** **SO1.10** **SO1.11** **SO1.12** **SO1.13** **SO1.14** **SO1.15**	L1. Safety measures while in Lab; L2. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; L3. Washing, drying and sterilization of glassware; L4. Drying of solvents/ chemicals; L5. Handling of chemical substances; Weighing and preparation of solutions of different strengths and their dilution; L6. Handling techniques of solutions; L7. Preparation of different agro-chemical doses in field and pot applications;		As mentioned in page number ……..

			L8. Preparation of solutions of acids; L9. Neutralisation of acid and bases; L10. Preparation of buffers of different strengths and pH values; L11. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing; L12. Preparation of media and methods of sterilization; L13. Seed viability testing, testing of pollen viability; L14. Tissue culture of crop plants; L15. Description of flowering plants in botanical terms in relation to taxonomy		

Semester- II

Course Code: **FLS 507**

Course Title: **Nursery Management for Ornamental Plants**

Pre- requisite: Familiarization with principles and practices of propagation and nursery management for Ornamental plants

Rationale: Nursery management is very essential for production of quality planting material in ornamental plants. The course gives a thorough understanding of propagation of different ornamental plants, nursery management, standards, law and certification.

Course Outcomes:

FLS 507.1: To develop basic and advance knowledge in the information about the importance and present scenario of nursery industry

FLS 507.2: To understand the principles and methods of asexual propagation and nursery management in ornamental crops

FLS 507.3: To impart knowledge and develop understanding about micro propagation techniques for mass production of quality planting stock.

FLS 507.4: The students will be able to gain knowledge about different growing structures for nursery raising and develop their skill on it.

FLS 507.5: Students become able to understand about nursery and its type, Nursery act, PPV& FR act and Quarantine system

FLS 507.6: Students will able to address Hi- tech Nursery and garden center

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)	FLA 507	Nursery Management for Ornamental Plants	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

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 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
PCC	FLA 507	Nursery Management for Ornamental Plants	15	30	0	0	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.

FLA 507.1: To develop basic and advance knowledge in the information about the importance and present scenario of nursery industry

Approximate Hours

Item	Approximate Hours
CI	06
LI	0
SW	1
SL	02
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 1.1. Understand the scope and importance of nursery industry in India **SO 1.2.** Ability to know the basic requirement of nursery industry **SO 1.3.** Student will able to examine the various criteria for evaluation healthy seed production **SO 1.4.** To understand the need of nursery management in ornamental crops **SO1.5.** Develop required entrepreneurial acumen.		**Unit-1.0** Scenario of nursery industry and sexual propagation: Importance and present scenario and status of nursery industry in India and in the world, life cycles in plants, Propagation methods, Factors influencing seed germination of flower crops, dormancy, seed quality, packing, storage, certification, testing. Hormonal regulation of germination and seedling growth. 1. Importance and present scenario and status of nursery industry in India and in the world 1.2 Propagation methods 1.3 Factors influencing seed germination of flower crops, 1.4 Dormancy, 1.5 Seed quality, packing, storage, certification, testing. 1.6 Hormonal regulation of germination and seedling growth.	1. Seed germination process 2. Dormancy breaking methods

SW-1 Suggested Sessional Work (SW):

m. Assignments:

viii. Certification of ornamental seeds

n. Mini Project:

o. Other Activities (Specify):

FLS 507.2: To understand the principles and methods of asexual propagation and nursery management in ornamental crops

Approximate Hours

Item	Approximate Hours
CI	08
LI	10
SW	02
SL	02
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. The students will be able to gain knowledge about different propagation techniques and develop their skill on it. **SO 2.2.** A thorough understanding of role of PGR in quality seedling production **SO 2.3.** Determine the selection of mother plants or scion or rootstock for avoiding the incompatibility **SO 2.**4 Develop the required skills on commercial production management **SO 2.5** Be able to start ornamental nursery enterprises	1. Anatomical studies in rooting of cutting and graft union 2. Preparation and use of PGRs 3. Practice of propagation through specialized structures 4. Cuttings and layering, 5.Budding and grafting	**Unit-2.** Asexual propagation: Methods of asexual propagation, rooting of soft and hard wood cutting under mist. Role of Plant growth regulators. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principles and methods, budding and grafting – selection of elite mother plants. Stock, scion and inter stock, relationship – Incompatibility. 2.1. Methods of asexual propagation, 2.2 Rooting of soft and hard wood cutting under mist. 2.3 Role of Plant growth regulators 2.4 Physiological, anatomical and biochemical aspects of root induction in cuttings. 2.5 Layering – principles and methods 2.6 Budding 2.7 Grafting 2.8 Selection of elite mother plants. Stock, scion and inter stock, relationship – Incompatibility.	1. Role of chemicals in propagation 2. Merits and demerits of different propagation methods

SW-2 Suggested Sessional Work (SW):

c. Assignments:

7. Use of different PGR in nursery

d. Mini Project:

3. Make a poster on different asexual methods of propagation

ciii. Other Activities (Specify):

FLS 507.3: To impart knowledge and develop understanding about micro propagation techniques for mass production of quality planting stock.

Approximate Hours

Item	Approximate Hours
CI	06
LI	04
SW	02
SL	01
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1. The students will be able to gain knowledge about Micropropagation techniques for ornamental crops **SO 3.2.** Identify and describe the various methods of in-vitro culture and hardening process for quality seedling. **SO3.3.** Understand the micrografting and meristem culture for healty seedling production **SO 3.4.** Develop basic knowledge about transport of micro propagules **SO 3.5.** Understand the role of biotechnology tools in ornamental plants	1.Micropropagation of ornamental crops 2. Hardening of ornamental crops	**Unit 3** Micro propagation: Micro-propagation – principles and concepts, commercial exploitation in flower crops. Techniques – in-vitro clonal propagation, direct organogenesis, embryogenesis, micro grafting, meristem culture. Hardening, packing and transport of micro-propagules **3.1.** Micro-propagation – principles and concepts **3.2.** Commercial exploitation in flower crops. **3.3.** In-vitro clonal propagation, **3.4** Direct organogenesis, embryogenesis **3.5**. Micro grafting, meristem culture **3.6.** Hardening, packing and transport of micro-propagules	1. Biotechnology tools used in ornamental crops

SW-3 Suggested Sessional Work (SW):

j. **Assignments:**
   Invitro culture of ornamental crops
k. **Mini Project:**
l. **Other Activities (Specify):**
   i. Visit to tissue culture labs

FLS 507.4: The students will be able to gain knowledge about different growing structures for nursery raising and develop their skill on it.

Approximate Hours

Item	Approximate Hours
CI	03
LI	02
SW	03
SL	01
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 4.1. Understand the uses of growing structures in nursery raising **SO 4.2.** Able to establish and maintain the nursery growing structures **SO4.3.** Understand about automation in nursery management	1. Preparation of growing media	**Unit 4.** Growing structures: Growing structures like mist chambers, tunnels, lath house, net house, growing media types, soil less culture and containers. Automation in nursery management. 4.1. Growing structures like mist chambers, tunnels, lath house, net house 4.2. Growing media types, soil less culture and containers 4.3. Automation in nursery management.	1.Soil less horticulture

SW-4 Suggested Sessional Work (SW):

j. Assignments:

i. Classification of growing structures of nursery raising of ornamentals

k. Mini Project:

i. Collect the samples of soil less medias

l. Other Activities (Specify):

i. Visit to nursery growing structures

FLS 507.5: Students become able to understand about nursery and its type, Nursery act, PPV& FR act and Quarantine system

Approximate Hours

Item	Approximate Hours
CI	05
LI	02
SW	02
SL	02
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Able to understand the different sanitary and phyto- sanitary issues regarding nursery. **SO5.2** Understand the nursery act. **SO5.3** Student will understand the rights of farmers in respect of their contributions made at any time in conserving, for the development of new plant varieties. **SO5.4** Understood the growth of seed industry in the country which will ensure the availability of high quality seeds and planting material to the farmers.	1. Identification and production of plug plants, seedlings and saplings	**Unit 5:** Sanitary and phyto-sanitary issues: Nursery – types, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, PPV&FR act and Quarantine system in India. Important quarantine pests and diseases, sanitary and phyto-sanitary issues threats to nursery Industry. 5.1 Nursery – types, components, planning and layout. 5.2 Nursery management practices for healthy propagule production. 5.3 Nursery Act, PPV&FR act 5.4 Quarantine system in India. Important quarantine pests and diseases, 5.5 Sanitary and phyto-sanitary issues threats to nursery Industry.	1. Nursery quarantine acts 2. Types of Nursery

SW-5 Suggested Sessional Work (SW):

c. Assignments:

i. Sanitary and phytosanitary measures of ornamental nursery

d. Mini Project:

i. Prepare a chart of PPV and FR

e. Other Activities (Specify):

FLS 507.6: Students will able to address Hi- tech Nursery and garden centers

Approximate Hours

Item	Approximate Hours
CI	02
LI	0
SW	02
SL	01
Total	05

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO6.1 Students will able to address Hi- tech Nursery and garden center **SO6.2** Able to understand the different tools and equipment used in hi-tech nursery .		**Unit 6:** Standards: Nursery standards, Hi-tech nurseries, garden centers. 6.1 Nursery standards 6.2 Hi-tech nurseries, garden centers.	1. Hi tech horticulture

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Enlist the different tools, gadgets, machinery used in high tech nursery unit

b. Other Activities (Specify):

i. Visit to ornamental nursery

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
FLS507.1: To develop basic and advance knowledge in the information about the importance and present scenario of nursery industry	6	1	2	9
FLS507.2: To understand the principles and methods of asexual propagation and nursery management in ornamental crops	18	2	2	22
FLS507.3: To impart knowledge and develop understanding about micro propagation techniques for mass production of quality planting stock.	10	2	1	13
FLS507.4: The students will be able to gain knowledge about different growing structures for nursery raising and develop their skill on it.	5	3	1	9
FLS507.5: Students become able to understand about nursery and its type, Nursery act, PPV& FR act and Quarantine system	7	2	2	11
FLS507.6: Students will able to address Hi-tech Nursery and garden center	2	2	1	5

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Scenario of nursery industry and sexual propagation: Importance and present scenario and status of nursery industry in India and in the world, life cycles in plants, Propagation methods, Factors influencing seed germination of flower crops, dormancy, seed quality, packing, storage, certification, testing. Hormonal regulation of germination and seedling growth.	2	6	2	10
CO 2	Asexual propagation: Methods of asexual propagation, rooting of soft and hard wood cutting under mist. Role of Plant growth regulators. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principles and methods, budding and grafting – selection of elite mother plants. Stock, scion and inter stock, relationship – Incompatibility.	6	2	2	10
CO 3	Micro propagation: Micro-propagation – principles and concepts, commercial exploitation in flower crops. Techniques – in-vitro clonal propagation, direct organogenesis, embryogenesis, micro grafting, meristem culture. Hardening, packing and transport of micro-propagules	3	1	4	8
CO 4	Growing structures: Growing structures like mist chambers, tunnels, lath house, net house, growing media types, soil less culture and containers. Automation in nursery management.	2	3	5	10
CO 5	Sanitary and phyto-sanitary issues: Nursery – types, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, PPV&FR act and Quarantine system in India. Important quarantine pests and diseases, sanitary and phyto-sanitary issues threats to nursery Industry.	3	3	2	8
CO 6	Standards: Nursery standards, Hi-tech nurseries, garden centers.	2	1	1	4
	Total	**18**	**16**	**16**	**50**

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

The end of semester assessment for **Nursery Management for Ornamental Plants** 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. Hands on training of different techniques
6. Exposure visits
7. Demonstration
8. Flip classes
9. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Propagation of Horticultural Plants	Adriance GW and Brison FR	Biotech Books	2000
2	Plant Propagation: Principles and Practices	Davies Fred T Jr., Geneve RL, Wilson SB, Hartmann HT and Kester DL	Pearson Publication	2018
3	Propagation of Horticultural Crops	Rajan S and Baby LM.	New India Publication	2007
4	International Turf Management Handbook	Deepa H. Dwivedi, Navaldey Bharti	Satish Serial Publishing House	2019
5	Floriculture and Ornamental Plants	S. K. Datta, Youdh Chand Gupta	Springer Nature Singapore	2022

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Semester- II

Course Code: VSC 504

Course Title: **Principles of vegetable breeding**

Pre- requisite: The Student should have basic knowledge of principles of breeding practices in vegetable Crops.

Rationale: Plant breeding has been practiced for thousand of years since beginning of human civilization vegetable breeding which is an art and science of changing the traits of plants in order to provide desired traits has been used to improve the quality of nutrition in products for human beings. All the basic principles of breeding should be emphasized and implemented for boosting of the breeding programs.The students of vegetable science taking taking breeding as minor subject need to have an understanding of vegetable breeding principles and it's methods.

Course Outcomes:

VSC504.1: To understand about importance, history and evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding.

VSC504.2: Students will have the ability to apply the knowledge of various selection procedures to be implemented for breeding of vegetable crops.

VSC504.3: Student will be able to Understand about Heterosis breeding.

VSC504.4: Understanding about mutation and polyploidy breeding

VSC504.5: Idea on Ideiotype breeding.

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)	VSC504	Principles of Vegetable breeding.	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

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PR)						End Semester Assessment (ESA)	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		(PRA + ESA)
PCC	VSC 504	Principles of vegetable breeding	15	30	0	0	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.

VSC 504.1: To understand basic concepts of vegetable breeding, history, evolutionary aspects of vegetable crops and it's variation from cereal crop breeding.

Approximate Hours

Item	Approximate Hours
CI	3
LI	0
SW	1
SL	2
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 1.1. Understand about importance of vegetable breeding. SO 1.2. Understand about history of vegetable breeding SO1.3.Understand about evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding.		**Unit-1. Importanc, history and evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding.** 1.1. Importance of vegetable breeding. 1.2.History of vegetable breeding. 1.3. Evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding.	1.Importance of vegetable breeding. 2.History of vegetable breeding.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Concepts of importance of vegetable breeding.

b. **Mini Project: i Preparation of chart showing history of vegetable breeding.**

c. Other Activities (Specify):

VSC504.2: Students will have the ability to apply the Knowledge of various selection procedure to be implemented in breeding of vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	4
LI	2
SW	2
SL	2
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Understandthe techniques of selfing and crossing. SO2.2. Understand the breeding systems and it's methods. SO2.3. Understandthe selection procedures and hybridization. SO2.4. Understandthe Breeding for Abiotic and Biotic stresses,Water use efficiency and nutrients use efficiency.	1.Selfing and crossing of different Vegetables.	Unit -2 *Selection procedures*- Techniques of selfing and crossing; Breeding systems and methods; Selection procedures and hybridization; Genetic architecture; Breeding for biotic stress (diseases, insect pests and nematode), abiotic stress (temperature, moisture and salt) resistance and quality improvement; Breeding for water use efficiency (WUE) and nutrients use efficiency (NUE**).** 2.1. Techniques of selfing and crossing. 2.2 Breeding systems and methods. 2.3. Selection procedures and hybridization. 2.4. Genetic architecture, Breeding for Abiotic and Biotic stresses, Water use efficiency and nutrients use efficiency.	1. Hybridization procedures. **2.** Selfing and crossing techniques.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

a. Various selection procedures.

b. Mini Project:

1. Preparation of Chart showing different hybridization procedures.

c. Other Activities (Specify):

VSC504.3: Student will be able to understand Heterosis breeding in different vegetable crops.

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1. Understand the concepts of Heterosis breeding. **SO 3.2.** Understand about types of Heterosis breeding. **SO 3.3.** Understand the mechanism and basis of Heterosis. **SO 3.4.** Understand the male sterility, Self incompatibility and sex forms in various vegetable crops.	1. Induction of Heterosis in vegetable breeding.	**Unit 3. Heterosis breeding- Types, mechanisms and basis of heterosis, facilitating mechanisms like male sterility, self-incompatibility and sex forms.** **3.1.** Types, mechanism and basis of Heterosis. **3.2.** Facilitating mechanism like make sterility, Self-incompatabilty and sex forms.	1. Different types of Heterosis in vegetable breeding.

SW-3 Suggested Sessional Work (SW):

a. Assignments:

Note on Heterosis breeding in different vegetable crops.

b. Mini Project:

c. Other Activities (Specify):

VSC504.4: Understanding on Mutation and Polyploidy breeding.

Item	Approximate Hours
CI	2
LI	2
SW	2
SL	2
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 4.1. Understand the Mutation breeding. SO4.2. Understand the Polyploidy breeding. SO4.3. Understand the improvement of asexually propagated Vegetable crops and vegetables suitable for Protected Environment.	1. Breeding systems of male filial generation of different Vegetables.	**Unit 4.** Mutation and Polyploidy breeding; Improvement of asexually propagated vegetable crops and vegetables suitable for protected environment. 4.1 understand the concepts of Mutation and Polyploidy breeding in different vegetable crops. 4.2. Improvement of asexually propagated Vegetable crops and vegetables suitable for Protected Environment.	1Concepts of Polyploidy breeding. 2.Vegetables suited for Protected Environment.

SW-4 Suggested Sessional Work (SW):

ii. Assignments:

2. Mutation and Polyploidy breeding.

iii. Mini Project:

i. Prepare chart showing different Mutations and Polyploidy breeding.

iv. Other Activities (Specify):

VSC504.5: Understand the concepts of Ideiotpye breeding in vegetable crops.

Item	Approximate Hours
CI	4
LI	2
SW	2
SL	2
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 5.1. Understand the concepts of Ideiotpye breeding. SO 5.2. Understand Varietal release procedures. SO5.3. Understand DUS testing in vegetable crops. SO5.4. Understand In-Vitro and molecular techniques in vegetable crops.	1.Application of Biotechnology and lab procedures.	**Unit-5.** Ideotype breeding- Ideotype breeding; varietal release procedure; DUS testing in vegetable crops; Application of In-vitro and molecular techniques in vegetable improvement. 1.1. Meaning of Ideiotpye breeding. 1.2. Varietal release procedures in vegetable crops. 1.3. DUS testing in vegetable crops. 1.4. Application of Biotechnology and lab procedures	1.Invitro and molecular techniques in vegetable crops. 2.Ideotype breeding in vegetable crops.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

i. Ideiotype breeding in different vegetable crops.

b. Mini Project:

i Prepare chart showing different DUS testing in vegetable 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)
VSC504.1: To understand importance, history and evolutionary aspects in vegetable breeding and it's variation from cereal crop breeding.	3	1	2	6
VSC504.2: Students will have the ability to apply the Knowledge of selection procedures in vegetable crops.	6	2	2	10
VSC,504.3: Student will be able to understand Heterosis breeding in vegetable crops.	4	1	1	6
VSC504.4: Understanding on Mutation and Polyploidy breeding in vegetable crops.	4	2	2	8
VSC504.5: Idea on Ideiotpye breeding in vegetable crops.	6	2	2	10
Total	**23**	**08**	**09**	**40**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Understand about lmportance, history and evolutionary aspects of vegetable crops and their variations from cereal crop breeding.	5	5	0	10
CO 2	Understand the concepts of selfing and crossing in vegetable crops. 2.1 Practice of selfing and crossing in vegetable crops.	03	03	04	10
CO 3	Understand Heterosis breeding in different vegetable crops. 3.2 Induction of Heterosis in vegetable breeding.	03	03	04	10
CO 4	Understanding on Mutation and Polyploidy breeding. 4.1Breeding systems in male filial generation in vegetable crops	05	05	0	10
CO 5	Understand the concepts of Ideiotpye breeding. 5.1 Application of Biotechnology and lab procedures.	03	03	04	10

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

The end of semester assessment for **Principles of vegetable breeding** 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	Genome mapping and molecular breeding in plants-Vegetables.	Kole, CR	Springer publication, USA.	2007.
2	Principles of plant breeding	Allard, RW	John Wiley and sons, USA.	1960.
3	Vegetable breeding (Vol.I,II and III	Kalloo, G	CRC Press, USA	2007.
4	Advances in vegetable breeding	Singh, Pundhan	Kalyani Publishers, New Delhi.	2002.
5	Genetics.	Russell PJ.	The Benzamin/ Cummings Publ. Co	1998
6	Genetics.	Singh BD.	Kalyani Publishers (2nd Revised Edition)	2009
7	Genetics.	Snustad DP and Simmons MJ.	4th Ed. John Wiley and Sons. 6th Edition International Student Version edition	2006
8	Genetics.	Stansfield WD.	Schaum Outline Series Mc Graw Hill	1991
9	Genetics (III Ed).	Strickberger MW.	Prentice Hall, New Delhi, India; 3rd ed.,	2005, 2015
10	Principles of Genetics.	Tamarin RH.	Wm. C. Brown Publs., McGraw Hill Education; 7 edition	1999
11	Practical Manual on Basic and Applied Genetics.	Uppal S, Yadav R, Singh S and Saharan RP.	Dept. of Genetics, CCS HAU Hisar.	2005

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Cos, POs and PSOs Mapping
Course Code: VSC 504
Course Title: - Principles of vegetable breeding

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 504.1 To understand about importance, history and evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding. .	3	3	2	1	1	1	1	1	3	1	2	3	3	3	1	1	1	1
VSC 504.2 Students will have	3	3	2	1	2	1	1	1	3	2	2	1	2	2	1	1	1	1

the ability to apply the knowledge gained about origin, evolution and distribution of vegetable crops.																		
VSC 504.3 Student will be able to Understand about Heterosis breeding. management.	3	3	2	2	1	1	1	2	3	2	1	1	3	1	1	1	1	1
VSC 504.4 Understanding about mutation and polyploidy breeding management	3	3	1	3	2	1	1	2	3	1	2	3	2	2	1	1	1	1
VSC 504.5 Idea on Ideiotpye breeding	3	3	1	2	2	1	1	2	3	1	3	2	3	1	1	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Principles of Vegetable breeding.

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 504.CO 1 To understand about importance, history and evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding.	**SO1.1 SO1.2 SO1.3**		**Unit-1.0** .Importance , history and evolutionary aspects of vegetable breeding and it's variation from cereal crop breeding. 1.1, 1.2, 1.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 504.CO 2: Students will have the ability to apply the knowledge of various selection procedures to be implemented for breeding of vegetable crops. .	**SO2.1 SO2.2 SO2.3 SO2.4**	**2.1** Selfing and crossing of different Vegetables.	**Unit -2** Selection procedures- Techniques of selfing and crossing; Breeding systems and methods; Selection procedures and hybridization; Genetic architecture; Breeding for biotic stress (diseases, insect pests and nematode), abiotic stress (temperature, moisture and salt) resistance and quality improvement; Breeding for water use efficiency (WUE) and nutrients use efficiency (NUE). 2.1, 2.2, 2.3.2.4	As mentioned in page number …….
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 504.CO 3: Student will be able to Understand about Heterosis breeding.	**SO3.1 SO3.2 SO3.3**	3.1. Preparation of keys to the species and varieties	**Unit-3.0** Heterosis breeding- Types, mechanisms and basis of heterosis, facilitating mechanisms like male sterility, self-incompatibility and sex forms. 3.1, 3.2	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 504.CO 4: Understanding about mutation and polyploidy breeding	**SO4.1 SO4.2 SO4.3**	4.1. Survey, collection of allied species and genera locally available in vegetable crops	**Unit-4.0** Mutation and Polyploidy breeding; Improvement of asexually propagated vegetable crops and vegetables suitable for protected environment. 4.1, 4.2	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 504.CO 5: Idea on Ideiotpye breeding	**SO5.1 SO5.2 SO5.3**	5.1 Practices of Molecular markers. 5.2 Practice of molecular markers in vegetable taxonomy.5.4. Visit to commercial green house	**Unit-5.0** Ideotype breeding- Ideotype breeding; varietal release procedure; DUS testing in vegetable crops; Application of *In-vitro* and molecular techniques in vegetable improvement. 5.1, 5.2, 5.3, 5.4	As mentioned in page number ……

Cos, POs and PSOs Mapping
Course Code: FLS 507
Course Title: - Nursery Management for Ornamental Plants

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turfgrass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
FLS 507.1 : To develop basic and advance knowledge in the information about the	3	2	3	2	3	1	1	2	2	2	2	3	3	3	1	1	1	1

importance and present scenario of nursery industry																		
FLS 507.2 To understand the principles and methods of asexual propagation and nursery management in ornamental crops	3	2	3	2	2	1	1	1	2	1	2	2	3	2	1	1	1	1
FLS 507.3 To impart knowledge and develop understanding about micro propagation techniques for mass production of quality planting stock.	3	1	2	2	3	1	1	2	1	2	1	3	3	3	1	1	1	1
FLS 507.4 The students will be able to gain knowledge about different growing	3	2	3	2	2	1	1	2	3	1	2	3	2	3	1	1	1	1

structures for nursery raising and develop their skill on it.																		
FLS 507.5 Students become able to understand about nursery and its type, Nursery act, PPV& FR act and Quarantine system	3	2	3	1	2	1	3	1	2	1	2	1	2	2	1	2	1	1
FLS 507.6 Students will able to address Hi-tech Nursery and garden center	3	3	3	2	2	1	1	1	2	2	2	2	3	3	1	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Nursery Management for Ornamental Plants

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 507.CO 1: To develop basic and advance knowledge in the information about the importance and present scenario of nursery industry	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-1.0** Scenario of nursery industry and sexual propagation: Importance and present scenario and status of nursery industry in India and in the world, life cycles in plants, Propagation methods, Factors influencing seed germination of flower crops, dormancy, seed quality, packing, storage, certification, testing. Hormonal regulation of germination and seedling growth. 1.1, 1.2, 1.3. 1.4, 1.5, 1.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 507.CO 2: To understand the principles and methods of asexual propagation and nursery management in ornamental crops	**SO2.1** **SO2.2** **SO2.3** **SO2.4** **SO2.5**	2.1 Anatomical studies in rooting of cutting and graft union 2.2Preparation and use of PGRs 2.3Practice of propagation through specialized structures 2.4 Cuttings and layering, 2.5 Budding and grafting	**Unit-2.0 –** Asexual propagation: Methods of asexual propagation, rooting of soft and hard wood cutting under mist. Role of Plant growth regulators. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principles and methods, budding and grafting – selection of elite mother plants. Stock, scion and inter stock, relationship – Incompatibility 2.1, 2.2, 2.3. 2.4, 2.6, 2.7, 2.8	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 507.CO 3: To impart knowledge and develop understanding about micro propagation techniques for mass production of quality planting stock.	**SO3.1** **SO3.2** **SO3.3** **SO3.4** **SO3.5**	3.1 Micropropagation of ornamental crops 3.2 Hardening of ornamental crops	**Unit-3.0** Micro propagation: Micro-propagation – principles and concepts, commercial exploitation in flower crops. Techniques – in-vitro clonal propagation, direct organogenesis, embryogenesis, micro grafting, meristem culture. Hardening, packing and transport of micro-propagules. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6,	FLS 507.CO 4: The students will be able to gain knowledge about	**SO4.1** **SO4.2** **SO4.3**	4.1. Preparation of growing media	**Unit-4.0** Growing structures: Growing structures like mist chambers, tunnels, lath house, net	As mentioned in page

7, 8, 9, 10, 11	different growing structures for nursery raising and develop their skill on it.			house, growing media types, soil less culture and containers. Automation in nursery management. 4.1, 4.2, 4.3.	number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 507.CO 5: Students become able to understand about nursery and its type, Nursery act, PPV& FR act and Quarantine system	**SO5.1** **SO5.2** **SO5.3** **SO5.4**	5.1. Identification and production of plug plants, seedlings and saplings	**Unit-5.0** Sanitary and phyto-sanitary issues: Nursery – types, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, PPV&FR act and Quarantine system in India. Important quarantine pests and diseases, sanitary and phyto-sanitary issues threats to nursery Industry. 5.1, 5.2, 5.3. 5.4, 5.5	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 507.CO 6: Students will able to address Hi-tech Nursery and garden center	**SO6.1** **SO6.2**		**Unit-6.0** Standards: Nursery standards, Hi-tech nurseries, garden centers. 6.1, 6.2	As mentioned in page number ……

Semester- II

Course Code: **FLS 506**

Course Title: **Indoor Plants and Interior scaping**

Pre- requisite: To facilitate deeper understanding of the benefits of indoor plants, selection,
designing and their management.

Rationale: Indoor plants are an important component of floriculture. They not only improve the aesthetic environment of indoors but are also known to improve indoor air quality. The students in floriculture need up to date knowledge on factors affecting indoor growing, types, cultural operations and different principles of interior scaping.

Course Outcomes:

FLS 506.1: Appraise a critical knowledge about the Interior scaping

FLS 506.2: Appraise a critical knowledge about the taxonomic identification of different types of indoor plants that are specifically used for interior landscaping

FLS 506.3: To impart knowledge and skill on cultural methods, management and nursery standards

FLS 506.4: To impart knowledge and skill on specialised gardens including miniature gardens and plant stand

FLS 506.5: The students will be apprised of creation of vertical gardens and have a thorough understanding of its history and maintenance

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)	FLA 506	Indoor Plants and Interior scaping	1	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

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		(PRA + ESA)
PCC	FLA 506	Indoor Plants and Interior scaping	15	30	0	0	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.

FLA 506.1: Appraise a critical knowledge about the Interior scaping

Approximate Hours

Item	Approximate Hours
CI	02
LI	0
SW	01
SL	01
Total	04

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 1.1. Understand the scope and importance of interior scaping **SO 1.2.** Ability to know the causes of indoor air pollution **SO 1.3.** Student will able to examine the various oxygenated plants to improve indoor air quality		**Unit-1.0** Importance and scope: Importance and scope of indoor plants and Interior scaping, Indoor plants and Indoor air quality. 1.1 Importance and scope: Importance and scope of indoor plants and Interior scaping 1.2 Indoor plants and Indoor air quality	1. Benefits of indoor plants

SW-1 Suggested Sessional Work (SW):

p. Assignments:

ix. Factors responsible for indoor air pollution

q. Mini Project:

r. Other Activities (Specify):

FLS 506.2: Appraise a critical knowledge about the taxonomic identification of different types of indoor plants that are specifically used for interior landscaping

Approximate Hours

Item	Approximate Hours
CI	04
LI	02
SW	02
SL	02
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Demonstrate the ability to identify important indoor plants **SO 2.2.** Identify the various factors affecting growth, development and flowering of Indoor plants. **SO 2.3.** Determine the role indoor plants in pollution mitigation **SO 2.**4 To provide knowledge about the principles of Interior scaping	1. Identification of important house plants	**Unit-2.** Classification and principles: Factors affecting growth, development and flowering of Indoor plants. Classification of indoor plants based on light, temperature, humidity and pollution tolerance, Description and cultivation of various indoor plants. Principles of Interior scaping, Role in pollution mitigation. 2.1. Factors affecting growth, development and flowering of Indoor plants. 2.2 Classification of indoor plants based on light, temperature, humidity and pollution tolerance 2.3 Principles of Interior scaping 2.4 Role in pollution mitigation.	**7.** Indoor plant species and varieties **8.** Classification of plants based on factors affecting their growth and development

SW-2 Suggested Sessional Work (SW):

e. Assignments:

8. Prepare a chart of different indoor plants, who mitigate the indoor pollution

f. Mini Project:

4. Collect different indoor plants species/varieties and make a herbarium

civ. Other Activities (Specify):

FLS 506.3: To impart knowledge and skill on cultural methods, management and nursery standards

Approximate Hours

Item	Approximate Hours
CI	04
LI	06
SW	02
SL	02
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1. Describe the cultural methods used for growing various indoor plants **SO 3.2.** Understand the special cultural and management practices applied in indoor plants cultivation **SO 3.3.** The student will gain knowledge about marketing channels, business models including plant rentals	1. Media and containers used in indoor gardening 2. Propagation of indoor plants 3. Cultural operations, maintenance and economics of indoor plants	**Unit 3** Cultural operations: Containers and substrates, preparation of growing media, propagation, training, grooming, nutrition, And management of disease, pests and weeds. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. Media standards, Nursery and Export standards for potted plants, Nursery standards. **3.1.** Containers and substrates, preparation of growing media **3.2.** Propagation, training, grooming, nutrition, And management of disease, pests and weeds. **3.3.** Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. **3.**4. Media standards, Nursery and Export standards for potted plants, Nursery standards.	1. Cultural practices of different indoor plants 2. Market chain of indoor plants

SW-3 Suggested Sessional Work (SW):

m. Assignments:

n. Mini Project:

i. Prepare model for interior scaping

o. Other Activities (Specify):

i. Visit to indoor nursery

FLS 506.4: To impart knowledge and skill on specialized gardens including miniature gardens and plant stand

Approximate Hours

Item	Approximate Hours
CI	03
LI	06
SW	02
SL	02
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 4.1. Able to develop the skill on miniature gardening **SO 4.2.** Able to establish and maintain the bonsai plants **SO 4.3.** Illustrate knowledge about the different types of container gardens	1. Making of terrariums, and their economics 2. Making of bottle garden and their economics 3. Making of dish garden and their economics	**Unit 4.** Special gardens: Special gardens including miniature gardens and plant stand. Presentations like dish, terrarium, bottle gardens, hanging baskets, window boxes and Bonsai. 4.1. Miniature gardens and plant stand 4.2. Dish, terrarium, bottle gardens, hanging baskets, window boxes 4.3. Bonsai	1.Terrarium 2. Style of bonsai

SW-4 Suggested Sessional Work (SW):

m. Assignments:

i. Different types of Bonsai

n. Mini Project:

i Make terrarium, bottle garden, miniature garden

o. Other Activities (Specify):

FLS 506.5: The students will be apprised of creation of vertical gardens and have a thorough understanding of its history and maintenance

Approximate Hours

Item	Approximate Hours
CI	02
LI	02
SW	02
SL	01
Total	07

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Able to understand the concept of vertical gardening **SO5.2** Develop skill about installation and management of vertical garden	1. Making of vertical gardens and economics	**Unit 5:** Vertical gardens: Vertical gardens- History, planting material, structures, containers, substrate, water and nutrient management, supplemental lighting. 5.1 Vertical gardens- History, planting material, structures, containers 5.2 Substrate, water, nutrient management, supplemental lighting in vertical garden	1. Hydroponics

SW-5 Suggested Sessional Work (SW):

e. Assignments:

i. Enlist the different plants used in vertical gardening

f. Mini Project:

1. **i.** Make a live model of vertical gardens

f. 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)
FLS506.1: Appraise a critical knowledge about the Interior scaping	2	1	1	4
FLS506.2: Appraise a critical knowledge about the taxonomic identification of different types of indoor plants that are specifically used for interior landscaping	6	2	2	10
FLS506.3: To impart knowledge and skill on cultural methods, management and nursery standards	10	2	2	14
FLS506.4: To impart knowledge and skill on specialized gardens including miniature gardens and plant stand	9	2	2	13
FLS506.5: The students will be apprised of creation of vertical gardens and have a thorough understanding of its history and maintenance	4	2	1	07

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Importance and scope: Importance and scope of indoor plants and Interior scaping, Indoor plants and Indoor air quality.	3	5	2	10
CO 2	Classification and principles: Factors affecting growth, development and flowering of Indoor plants. Classification of indoor plants based on light, temperature, humidity and pollution tolerance, Description and cultivation of various indoor plants. Principles of Interior scaping, Role in pollution mitigation.	4	2	4	10
CO 3	Cultural operations: Containers and substrates, preparation of growing media, propagation, training, grooming, nutrition, And management of disease, pests and weeds. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. Media standards, Nursery and Export standards for potted plants, Nursery standards.	3	3	4	10
CO 4	Special gardens: Special gardens including miniature gardens and plant stand. Presentations like dish, terrarium, bottle gardens, hanging baskets, window boxes and Bonsai.	2	3	5	10
CO 5	Vertical gardens: Vertical gardens- History, planting material, structures, containers, substrate, water and nutrient management, supplemental lighting.	3	4	3	10
	Total	15	17	18	50

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

The end of semester assessment for **Indoor Plants and Interior scaping** 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. Hands on training of different techniques
6. Exposure visits
7. Demonstration
8. Flip classes
9. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	The Complete Houseplant Survival Manual	Barbara P.	Storey Publication	2005
2	Floriculture in India	Randhawa GS and Mukhopadhyay A	Allied Publication	1986
3	Indoor Gardening for Beginners	Timothy S. Morris	CreateSpace Independent Publishing	2014
4	The Indoor Garden Book	John Brookes	D. Kindersley	1994
5	Living With Plants	Sophie Lee	Hardie Grant London	2017

Curriculum Development Team:

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Cos, POs and PSOs Mapping
Course Code: FLS 506
Course Title: - Indoor Plants and Interior scaping

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
FLS 506.1 Appraise a critical knowledge about the Interior scaping	3	1	2	1	1	1	1	1	2	1	1	3	3	3	3	1	1	1
FLS 506.2 Appraise a critical knowledge about the taxonomic identification of different types of indoor	3	1	1	1	2	1	1	1	2	1	1	1	2	2	3	1	1	1

plants that are specifically used for interior landscaping																		
FLS 506.3 To impart knowledge and skill on cultural methods, management and nursery standards regulators.	3	2	2	1	1	1	1	1	2	1	1	1	3	1	3	1	1	1
FLS 506.4 To impart knowledge and skill on specialised gardens including miniature gardens and plant stand	3	2	2	1	2	1	1	1	1	1	1	3	2	2	2	1	1	1
FLS 506.5 The students will be apprised of creation of vertical gardens and have a thorough understanding of its history and maintenance	3	1	1	1	2	1	1	1	1	1	1	2	3	1	3	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Indoor Plants and Interior scaping

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 506.CO 1 Appraise a critical knowledge about the Interior scaping	**SO1.1 SO1.2 SO1.3**		**Unit-1.0** Importance and scope: Importance and scope of indoor plants and Interior scaping, Indoor plants and Indoor air quality. 1.1, 1.2	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 506.CO 2: Appraise a critical knowledge about the taxonomic identification of different types of indoor plants that are specifically used for interior landscaping .	**SO2.1 SO2.2 SO2.3 SO2.4**	**2.1** Identification of important house plants	**Unit-2.0 –** Classification and principles: Factors affecting growth, development and flowering of Indoor plants. Classification of indoor plants based on light, temperature, humidity and pollution tolerance, Description and cultivation of various indoor plants. Principles of Interior scaping, Role in pollution mitigation.2.1, 2.2, 2.3. 2.4	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 506.CO 3: To impart knowledge and skill on cultural methods, management and nursery standards	**SO3.1 SO3.2 SO3.3**	3.1Media and containers used in indoor gardening 3.2 Propagation of indoor plants 3.3 Cultural operations, maintenance and economics of indoor plants	**Unit-3.0** Cultural operations: Containers and substrates, preparation of growing media, propagation, training, grooming, nutrition, And management of disease, pests and weeds. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. Media standards, Nursery and Export standards for potted plants, Nursery standards 3.1, 3.2, 3.3, 3.4	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 506.CO 4: To impart knowledge and skill on specialised gardens including miniature gardens and plant stand	**SO4.1 SO4.2 SO4.3**	4.1 Making of terrariums, and their economics 4.2 Making of bottle garden and their economics 4.3 Making of dish garden and their economics	**Unit-4.0** Special gardens: Special gardens including miniature gardens and plant stand. Presentations like dish, terrarium, bottle gardens, hanging baskets, window boxes and Bonsai. 4.1, 4.2, 4.3	As mentioned in page number ……

PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	FLS 506.CO 5: The students will be apprised of creation of vertical gardens and have a thorough understanding of its history and maintenance.	**SO5.1 SO5.2**	5.1 Making of vertical gardens and economics	**Unit-5.0** Vertical gardens: Vertical gardens- History, planting material, structures, containers, substrate, water and nutrient management, supplemental lighting. 5.1, 5.2.	As mentioned in page number ……

Semester- II

Course Code: **VSC- 502**

Course Title: **Production of Warm Season Vegetable Crops**

Pre- requisite: To impart knowledge and skills on advancement in production technology of warm season vegetable crops

Rationale: Unlike cool-season vegetables, warm-season vegetable crops require higher soil and air temperature, thus, they are always planted after the last frost date ranging from late spring after the last frost date to late summer. Daytime temperature may still be warm enough but drop so much at night-time that the weather is not suitable for warm-season crops any longer. In general summer vegetables require a little higher temperature than winter vegetables for optimum growth. In summer vegetables, the edible portion is mostly botanical fruit. The students of vegetable science need to have an understanding of production technology of important warm season vegetable crops and thereafter their management.

Course Outcomes:

VSC 502.1: To Understand the Production technology of fruit vegetable crops.

VSC 502.2: Ability to know the package and practices of beans crops.

VSC 502.3: Student able to know the scientific production technology of cucurbits.

VSC 502.4: Understand the Package of practices tuber crops.

VSC 502.5: To elaborates the Production technology of leafy vegetable crops.

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)	VSC 502	Production of Warm Season Vegetable Crops	2	1	1	1	4	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 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
PCC	VSC 502	Production of Warm Season Vegetable Crops	15	30	0	0	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.

VSC 502.1: To Understand the Production technology of fruit vegetable crops.

Approximate Hours

Item	Approximate Hours
CI	08
LI	06
SW	06
SL	02
Total	22

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand about the Nutritional importance, origin and distribution, botany and taxonomy of tomato and brinjal **SO1.2** Understand the Commercial and hybrid varieties of tomato, brinjal and okra **SO1.3** Application of Production technology of tomato. **SO1.4** Introduction, commercial and nutritional importance, origin and area, production, productivity and constraints of hot pepper and sweet pepper **SO1.5** Introduces the Package of practices of hot pepper **SO1.6** Ability to understand the scientific cultivation of brinjal. **SO1.7** Understand the Post harvest handling and marketing of tomato and brinjal. **SO1.8** Application of Package of practices of okra	1. To study the Scientific raising of nursery and seed treatment of warm season vegetable crops. 2. Practices of Sowing, transplanting of warm season fruit vegetable crops. 3. To study of description of commercial varieties and hybrids of warm season vegetable crops.	**Unit I** **Fruit vegetables—Tomato, brinjal, hot pepper, sweet pepper and okra.** 1.1Nutritional importance, origin and distribution, botany and taxonomy of tomato and brinjal 1.2 Commercial and hybrid varieties of tomato, brinjal and okra 1.3 Production technology of tomato 1.4 Introduction, commercial and nutritional importance, origin and area, production, productivity and constraints of hot pepper and sweet pepper. 1.5 Package of practices of hot pepper 1.6 scientific cultivation of brinjal. 1.7 Post harvest handling and marketing of tomato and brinjal. 1.8 Package of practices of okra	1. improved varieties of Fruit vegetable crops. 2. Economical and physiological disorder tomato, brinjal and sweet pepper.

SW-1 Suggested Sessional Work (SW):

s. Assignments:

x. Production technology of tomato.

xi. Production technology of brinjal.

xii. Production technology of Sweet pepper and hot pepper

xiii. Production technology of okra

t. Mini Project:

vi. Varietal description of Fruit vegetable crops.

vii. Botanical description of Fruit vegetable crops.

VSC 502.2: Ability to know the package and practices of beans crops.

Item	Approximate Hours
CI	6
LI	6
SW	3
SL	2
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1. Understand the Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy of beans. **SO 2.2**. Understand the Commercial varieties/ hybrid varieties classification of beans **SO 2.3.** Application of Package and practices of French bean **SO 2.4.** Application of Production technology of Indian bean. **SO2.5** Understand the Production technology of cluster bean cow pea **SO2.6** Introduce the Pest and disease management and production economics of beans	1. Demonstration on methods of irrigation, fertilizers and micronutrients application of beans. 2. To study Mulching practices, weed management of warm season vegetable crops. 3. Use of plant growth substances in warm season vegetable crops	**Unit II** **Beans—French bean, Indian bean (Sem), cluster bean and cowpea.** 2.1. Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy of beans. 2.2 Commercial varieties/ hybrid varieties classification of beans 2.3 Package and practices of French bean 2.4 Production technology of Indian bean. 2.5 Production technology of cluster bean cow pea 2.6 Pest and disease management and production economics of beans	1. Improved varieties of beans 2. Production technology of beans

SW-2 Suggested Sessional Work (SW):

a. Assignments:

9. Package of Practices of French bean, Indian bean

b. Package of Practices of cluster bean and cowpea

c. Mini Project:

5. Flow chart of botanical description of beans

.Flow chart of varietal description of beans

VSC 502.3: Student able to know the scientific production technology of cucurbits.

Approximate hours

Item	Approximate Hours
CI	08
LI	06
SW	03
SL	02
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1 Understand the Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints of cucurbits. **SO3.2** Ability to understand Improved and hybrid varieties of cucurbits. **SO3.3** Application of Production technology of cucumber **SO3.4** Understand the Production technology of melons **SO3.5** Application of Production technology of gourds and pumpkin. **SO3.6** Application of Production technology of Squashes. **SO3.7** Understand the roles of plant growth regulators, physiological disorders of cucurbits. **SO3.8** Understand about the Post-harvest management (grading, packaging and marketing), pest and disease management of cucurbits.	1. To study the use of plant growth substances in cucurbits. 2. Visit to commercial farm, greenhouse/ polyhouses 3. Identification of important pest and diseases and their control of cucurbits.	**Unit III** **Cucurbits—Cucumber, melons, gourds, pumpkin and squashes.** **3.1.** Introduction, commercial and nutritional importance, origin and distribution, botany and Taxonomy, area, production, productivity and constraints of cucurbits. **3.2** Improved and hybrid varieties of cucurbits **3.3** Production technology of cucumber **3.4** Production technology of melons **3.5** Production technology of gourds and pumpkin. **3.6** Production technology of Squashes. **3.7** roles of plant growth regulators, physiological disorders of cucurbits. **3.8** Post-harvest management (grading, packaging and marketing), pest and disease management of cucurbits.	6. Improved varieties of cucurbits crops 2. Special horticultural practices in cucurbits.

SW-3 Suggested Sessional Work (SW):

p. Assignments:

Package of practices cucumber and melons

Package of practices gourds, pumpkin and squashes

q. Mini Project:

Flow chart of botanical description of cucurbits crops.

VSC 502.4: Understand the Package of practices tuber crops.

Item	Approximate Hours
CI	04
LI	06
SW	03
SL	02
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints tuber crops. **SO4.2** Application of Package and practices of sweet potato, elephant foot yam. **SO4.3** Application of Package and practices of tapioca, taro and yam. **SO4.4** Understand the roles of Roles of plant growth regulators, physiological disorders and Post-harvest management (grading, packaging and marketing) in tuber crops.	1. Analysis of benefit to cost ratio of warm season vegetable crops. 2. Mulching practices, weed management in warm season vegetable crops. 3. Study of nutritional and physiological disorders in warm season vegetable crops.	**Unit IV** **Tuber crops—Sweet potato, elephant foot yam, tapioca, taro and yam.** 4.1. Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints Tuber rops. 4.2. Package and practices of sweet potato, elephant foot yam 4.3. Package and practices of tapioca, taro and yam 4.4. Roles of plant growth regulators, physiological disorders and Post-harvest management (grading, packaging and marketing) in tuber crops.	1. Commercial and hybrid varieties of tuber crops 2. Package and practices of tuber crops.

SW-4 Suggested Sessional Work (SW):

p. Assignments:

Package and practices of sweet potato

Package and practices of tapioca and taro

q. Mini Project:

j. Flowchart of botanical description of warm season tuber crops.

VSC 502.5: To elaborates the Production technology of leafy vegetable crops.

Item	Approximate Hours
CI	04
LI	06
SW	03
SL	02
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand Commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity of warm season leafy vegetables. **SO5.2** Application of Scientific cultivation of amaranth. **SO5.3**. Application of Production technology of drumstick. **SO 5.4.** Understand the Roles of plant growth regulators, physiological disorders in warm season leafy vegetables.	5. Studies on hydroponics, aeroponics and other soilless culture of warm season leafy vegetables. 6. Preparation of cropping scheme for commercial farms 7. Visit to vegetable market	**Unit V** **Leafy vegetables—Amaranth and drumstick.** 1.7. Commercial and nutritional importance, origin and distribution, botany and Taxonomy, area, production, productivity of warm season leafy vegetables. 1.8. Scientific cultivation of amaranth. 1.9. Production technology of drumstick 1.10. Roles of plant growth regulators, physiological disorders in warm season leafy vegetables.	5. Improved varieties of warm season leafy vegetable crops. 6. Nutritional importance of warm season leafy vegetable crops.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Package of practices of Amaranth.

Package of practices of drumstick.

b. Mini Project:

ii. Flowchart of botanical description of warm season leafy vegetable corps.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
VSC 502.1: To Understand the Production technology of fruit vegetable crops.	14	06	02	22
VSC 502.2: Ability to know the package and practices of beans crops**.**	12	03	02	17
VSC 502.3: Student able to know the scientific production technology of cucurbits.	14	03	02	19
VSC 502.4: Understand the Package of practices tuber crops.	10	03	02	15
VSC 502.5: To elaborates the Production technology of leafy vegetable crops.	10	03	02	15
Total	**60**	**18**	**10**	**88**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Fruit vegetables—Tomato, brinjal, hot pepper, sweet pepper and okra.**	04	04	02	**10**
CO 2	**Beans—French bean, Indian bean (Sem), cluster bean and cowpea.**	03	03	04	**10**
CO 3	**Cucurbits—Cucumber, melons, gourds, pumpkin and squashes.**	05	03	02	**10**
CO 4	**Tuber crops—Sweet potato, elephant foot yam, tapioca, taro and yam.**	02	03	05	**10**
CO 5	**Leafy vegetables—Amaranth and drumstick.**	03	03	04	**10**
	Total	**17**	**16**	**17**	**50**

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

The end of semester assessment for **Production of Warm Season Vegetable 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
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to commercial horticultural unit
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	Vegetable crops. Vols. I-III	Bose TK, Kabir J, Maity TK, Parthasarathy VA and Som MG	Naya udyog	2003
2	Vegetable crops	Bose TK, Som MG and Kabir J. (Eds.).	Naya prokash.	1993
3	Advances in horticulture	Chadha KL and Kalloo G. (Eds.).	Malhotra publ. house	1993-1994
4	Hand book of horticulture	Chadha KL	ICAR	2002
5	Vegetable crops: production technology	Fageria MS, Choudhary BR and Dhaka RS.	Kalyani Publishers (2nd Revised Edition)	2000
6	Production technology of vegetable crops.	Singh S P	Agril. comm. res. centre.	1989
7	Vegetables, tuber crops and spices	Thamburaj S and Singh N.	ICAR	2004
8.	Vegetable production and technology	Hazra P.	New India publishing agency, New Delhi.	2019

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Cos, POs and PSOs Mapping
Course Code: VSC 502
Course Title: - Production of Warm Season Vegetable Crops

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO1	PSO 2	PSO3	PSO4	PSO5	PSO 6	PSO7	PSO8	PSO9	PSO10	PSO11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and under utilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different under utilized vegetable and spice crops	Student will apply different vegetable processing and post - harvest-handling methods for vegetables and flowers	Student will understand role of micro climate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 502.1 To Understand the Production technology of fruit vegetable crops.	3	3	2	3	3	1	1	3	3	3	3	3	2	1	1	1	1	1
VSC 502.2 Ability to know the	2	3	1	3	2	1	1	2	3	2	3	2	3	1	1	1	1	1

package and practices of beans crops.																		
VSC 502.3 Student able to know the scientific production technology of cucurbits.	2	2	2	2	3	1	1	3	2	3	2	3	2	1	1	1	1	1
VSC 502.4 Understand the Package of practices tuber crops.	3	2	2	3	2	1	1	3	3	2	3	3	2	1	1	1	1	1
VSC 502.5 To elaborates the Production technology of leafy vegetable crops.	2	3	2	3	2	1	1	2	2	2	2	2	3	1	1	1	1	1

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Production of Cool Season Vegetable Crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 502.CO 1: To Understand the Production technology of fruit vegetable crops.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6** **SO1.7** **SO1.8**	1.1 To study the Scientific raising of nursery and seed treatment of warm season vegetable crops. 1.2 Practices of Sowing, transplanting of warm season fruit vegetable crops. 1.3 To study of description of commercial varieties and hybrids of warm season vegetable crops.	**Unit-1.0** Fruit vegetables—Tomato, brinjal, hot pepper, sweet pepper and okra. . 1.1, 1.2, 1.3. 1.4, 1.5, 1.6, 1.7, 1.8	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 502.CO 2: Ability to know the package and practices of beans crops.	**SO2.1** **SO2.2** **SO2.3** **SO2.4** **SO2.5** **SO2.6**	2.1 Demonstration on methods of irrigation, fertilizers and micronutrients application of beans. 2.2To study Mulching practices, weed management of warm season vegetable crops. 2.3Use of plant growth substances in warm season vegetable crops	**Unit-2.0 –** Beans—French bean, Indian bean (Sem), cluster bean and cowpea. 2.1, 2.2, 2.3. 2.4, 2.6,	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 502.CO 3: Student able to know the scientific production technology of cucurbits.	**SO3.1** **SO3.2** **SO3.3** **SO3.4** **SO3.5** **SO3.6** **SO3.7** **SO3.8**	3.1. 1. To study the use of plant growth substances in cucurbits. 3.2 Visit to commercial farm, greenhouse/ polyhouses 3.3 Identification of important pest and diseases and their control of cucurbits.	**Unit-3.0** Cucurbits—Cucumber, melons, gourds, pumpkin and squashes. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8	As mentioned in page number …
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8,	VSC 502.CO 4: Understand the Package of practices tuber crops.	**SO4.1** **SO4.2** **SO4.3** **SO4.4**	4.1 Analysis of benefit to cost ratio of warm season vegetable crops. 4.2 Mulching practices, weed management in	**Unit-4.0** Tuber crops—Sweet potato, elephant foot yam, tapioca, taro and yam.	As mentioned in page number

9, 10, 11			warm season vegetable crops. 4.3Study of nutritional and physiological disorders in warm season vegetable crops.	4.1, 4.2, 4.3. 4.4, 4.5, 4.6	……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 502.CO 5: To elaborates the Production technology of leafy vegetable crops.	**SO5.1** **SO5.2** **SO5.3** **SO5.4**	5.1 Studies on hydroponics, aeroponics and other soilless culture of warm season leafy vegetables. 5.2 Preparation of cropping scheme for commercial farms 5.3 Visit to vegetable market	**Unit-5.0** Leafy vegetables—Amaranth and drumstick 5.1, 5.2, 5.3. 5.4	As mentioned in page number ……

Semester - II

Course Code: STAT 512
Course Title: EXPERIMENTAL DESIGNS

Pre-requisite: Experimental design is the process of carrying out research in an objective and controlled fashion so that precision is maximized and specific conclusions can be drawn regarding a hypothesis statement. Generally, the purpose is to establish the effect that a factor or independent variable has on a dependent variable.

Rationale: Experimental design is used to establish the effect an independent variable has on a dependent variable. An experimental design helps a researcher to objectively analyze the relationship between variables, thus increasing the accuracy of the result.

Course Outcomes:
CO1 Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.
CO2 Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.
CO3 Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.
CO4 Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.

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 (Cl+LI+SW+SL)	
Program Core (PCC)	STAT 512	EXPERIMENTAL DESIGNS	2	01	02	01	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

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment	Total Marks
			Class/Home Assignment 1 number 5 marks each (CA)	Class Test 2 (2 best out) 15 marks each (CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT+PA+AT)	(ESA)	(PRA+ESA)
PCC	STAT 512	ED	5	30	10	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.

STAT 512.1 Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.

Approximate Hours

Item	Appx. Hrs.
CI	3
LI	4
SW	1
SL	1
Total	09

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Design of Experiment is a tool to develop an experimentation strategy that maximizes learning using a minimum of resources. **SO1.2** Extensively used by engineers and scientists involved in the improvement of manufacturing processes to maximize yield and decrease variability. **SO1.3** It is widely used in many fields with broad application across all the natural and social sciences, to name a few: Biostatistics, Agriculture, Marketing, Software engineering, Industry etc.	1-Uniformity trial data analysis. 2- formation of plots and blocks, Fairfield Smith Law	**Unit-1.** Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control. **1.1**. Need for designing of experiments **1.2** characteristics of a good design **1.3** Basic principles of designs- randomization, replication and local control	1. Basic principles of designs- randomization, replication and local control.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Basic principles of designs- randomization, replication and local control.

b. Mini Project: -

c. Other Activities (Specify):

STAT 512.2 Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.

Approximate Hours

Item	Appx. Hrs.
CI	5
LI	6
SW	1
SL	2
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO2.1 Good experimental design is important in all research, it helps to ensure the data collection, data analysis and conclusions from a study, are valid (true). **SO2.2** Experiments are designed to test hypotheses, or specific statements about the relationship between variables.	1- Analysis of data obtained from CRD 2- - Analysis of data obtained from RBD 3- - Analysis of data obtained from LSD	**Unit-2** Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. **1.1** Uniformity trials **1.2** size and shape of plots and blocks **1.3**. Analysis of variance; Completely randomized design **1.4** Analysis of variance; randomized block design **1.5** Analysis of variance; Latin square design.	1. Analysis of variance; Completely randomized design, 2. Analysis of variance; randomized block design and Latin square design.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Simple Problems Based on Analysis of variance; Completely randomized design, randomized block design and Latin square design.

a. Other Activities (Specify):

STAT 512.3 Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	14
SW	1
SL	1
Total	22

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO3.1 Experimental methods introduce exogeneity, allowing researchers to draw conclusions about the effects of an event or a program. **SO3.2** An experimental design helps a researcher to objectively analyze the relationship between variables, thus increasing the accuracy of the result.	1- Analysis of factorial experiments without confounding. 2- Analysis of factorial experiments with confounding. 3- Analysis with missing data in CRD. 4- Analysis with missing data in RBD. 5- Analysis with missing data in LSD. 6- Split plot designs. 7- Strip plot designs	**Unit-3** Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. **1.1**. Factorial experiments, (symmetrical) **1.2** Factorial experiments, (asymmetrical) **1.3** orthogonality **1.4** partitioning of degrees of freedom **1.5**. Confounding in symmetrical factorial experiments **1.6**. Factorial experiments with control	1. Factorial experiments with control treatment.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Factorial experiments with control treatment.
Other Activities (Specify):

STAT 512.4 Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.

Approximate Hours

Item	Appx Hrs.
CI	16
LI	6
SW	1
SL	2
Total	25

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1.Ensure your experiment is unbiased. **SO4.2** Make sure your experiment is adequately powered. **SO4.3** Consider the range of applicability of your experiment.	1- Transformation of data. 2- Analysis of resolvable designs 3- Fitting of response surfaces.	**Unit-4** Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design-concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures. **1.1** Split plot **1.2** strip plot designs **1.3** Analysis of covariance **1.4** Missing plot techniques in randomized block. **1.5** Missing plot techniques in Latin square designs. **1.6** Transformations **1.7** crossover designs **1.8** balanced incomplete block design **1.9** resolvable designs **1.10** Applications of resolvable designs Lattice design **1.11** Lattice design **1.12** Applications of Lattice design **1.13** Alpha design-concepts. **1.14** Randomisation procedure. **1.15** Interpretation of results. **1.16** Response surfaces. Experiments with mixtures	1. Analysis of covariance and missing plot techniques in randomized block 2. Analysis of covariance and missing plot techniques in latin square designs

SW-1 Suggested Sessional Work (SW):
Assignments: Prepare the assignment on Analysis of covariance and missing plot techniques in randomized block and Latin square designs
Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C l)	Laboratory Lecture (L I)	Sessional Work (SW)	Self-Learning (S l)	Total hour (C l + LI+ SW +S l)
01: Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	03	04	01	01	09
02: Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.	05	06	01	02	14
03: Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	06	14	01	01	22
04: Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.	16	06	01	02	25
Total Hours	**30**	**30**	**04**	**06**	**70**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit title	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	04	04	04	12
CO-2	Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive	04	04	04	12
CO-3	Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	04	04	04	12
CO-4	Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.	05	04	05	14
	Total	17	16	17	50

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

The end of semester assessment for Experimental Designs 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:

S. No.	**Title**	**Author**	**Publisher**	**Edition &** Year
01	Basic Concepts and Application of Experimental Designs and Analysis	Felix Kusanedzie Sylverster Achio Edmund Ameko	Science PG	
02	Theory and Analysis of Experimental Designs	B.L. Agrawal	CBS	
03	Design and Analysis of Experiments	Angela Dean Daniel Voss	Springer	

Curriculum Development Team:

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Cos, POs and PSOs Mapping
Course Code: STAT 512
Course Title: - EXPERIMENTAL DESIGNS

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
STAT 512.1 Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	1	1	1	1	2	3	2	1	1	1	1	2	1	1	2	3	3	3
STAT 512.2 Analyze completely	1	1	1	1	2	2	2	1	2	2	1	1	1	1	1	2	2	3

randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.																		
STAT 512.3 Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	1	1	1	1	1	3	1	1	1	2	1	1	2	1	1	3	2	3
STAT 512.4 Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.	1	1	1	1	2	3	1	1	1	1	2	2	2	1	1	3	3	3

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Statistical Methods for Applied Science

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT 512.CO 1: Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	**SO1.1** **SO1.2** **SO1.3**	1.1. Uniformity trial data analysis. 1.2 Formation of plots and blocks, Fairfield Smith Law	**Unit-1.0** Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control. 1.1, 1.2, 1.3	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT 512.CO 2: Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.	**SO2.1** **SO2.2**	2.1. Analysis of data obtained from CRD 2.2. Analysis of data obtained from RBD 2.3. Analysis of data obtained from LSD	**Unit-2.0 –** Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. 2.1, 2.2, 2.3, 2.4, 2.5	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT 512.CO 3: Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	**SO3.1** **SO3.2**	3.1 Analysis of factorial experiments without confounding. 3.2 Analysis of factorial experiments with confounding. 3.3Analysis with missing data in CRD. 3.4 Analysis with missing data in RBD. 3.5 Analysis with missing data in LSD. 3.6 Split plot designs. 3.7Strip plot designs	**Unit-3.0** Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	STAT 512.CO 4: Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.	**SO4.1** **SO4.2** **SO4.3**	4.1Transformation of data. 4.2Analysis of resolvable designs 4.3 Fitting of response surfaces.	**Unit-4.0** Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design-concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures. 4.1, 4.2, 4.3. 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16	As mentioned in page number ……

Semester- II

Course Code: **VSC 507**

Course Title: **Protected cultivation of Vegetable crops**

Pre- requisite: Impart Knowledge among students about growing of Vegetable crops under protected environmental conditions.

Rationale: India is the second largest vegetable producer of vegetable crops in the world, however it's Vegetable production is much less than the requirements, if the balanced diet provided to every individual. There are different ways and means to achieve this target of protected cultivation which is the modification of the natural environment to achieve the optimum plant growth. Production of off-season vegetable nurseries under protected structure has become profitable business. The students of vegetable science should have basic understanding of protected cultivation of vegetable crops. Various types of structure has been developed for growing some high value crop by modifying the natural environmental conditions

Course Outcomes:

VSC507.1: To recall the scope and importance of protected cultivation, it's Principles, design and orientation.

VSC507.2: Students should understand different types of protected structures for cultivation of vegetable crops.

VSC 507.3: Students will demonstrate the effect of different environmental factors and it's manipulation for cultivation of vegetable crops.

VSC 507.4 Students understand the concepts of nursery raising techniques i.e. Hi- Tech vegetable production in protected structures by using different types of media.

VSC 507.5: Students understand the various cultivation practices of Vegetables in Protected structures.

VSC 507.6 Students understand the concepts of various problems related to Protected structures and Economics of Greenhouses.

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)	VSC 507	Protected cultivation of vegetable crops.	1	1	1	1	4	1+1=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
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		(PRA + ESA)
PCC	VSC 507	Protected cultivation of vegetable crops.	15	30	0	0	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

VSC 507.1: To recall the scope and importance of protected cultivation, it's Principles, design and orientation.

Approximate Hours

Item	App X Hrs
Cl	03
LI	04
SW	02
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO1.1 Understand concept and scope of Protected cultivation. **SO1.2**Ability to understand importance of Protected cultivation. **SO1.3**Understand about the principles, design and orientation of greenhouses/Polyhouses.	1.0 Principles and Methods of Protected structures. 1.2 Identification of various types of Protected structures.	**Unit-1.0** Scope and importance-Concept, scope and importance of protected cultivation of vegetable crops; Principles, design, orientation of structure, low and high cost polyhouses/ greenhouse structures. 1.1 Concepts and scope of Protected structures. 1.2 Importance of Protected structures. 1.3 Principles, design and orientation of Protected structures.	1. Principles of Protected structures. 2. orientation of Protected structures.

SW-1Suggested Sessional Work (SW):

c. Assignments:

a. Principles, design and orientation of Protected structures.

d. Mini Project:

i Prepare chart of importance of different types of Protected structures.

Other Activities (Specify):

VSC 507.2: Students should understand different types of protected structures for cultivation of vegetable crops.

Approximate Hours

Item	App X Hrs
Cl	03
LI	06
SW	02
SL	02
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO2.1 Understand the types of protected structures and it's classification. **SO2.2** Understand concept of climate control in Protected structures. **SO2.3**Understand the soil and soilless media for bed preparation in Protected structures. **SO2.4**Understand about the Design and installation of drip irrigation and fertigation systems.	**2.1**Practice of Classifying various Protected structures. **2.2**Using different growing media in Protected structures. **2.3** Practices of installation of drip irrigation and fertigation systems.	**Unit 2:** Types of protected structure-Classification and types of protected structures-greenhouse/ polyhouses, plastic-non plastic low tunnels, plastic walk in tunnels, high roof tunnels with ventilation, insect proof net houses, shed net houses, rain shelters, NVP, climate control greenhouses, hydroponics and aeroponics; Soil and soilless media for bed preparation; Design and installation of drip irrigation and fertigation system. **2.1**Classification and types of Protected structures-greenhouses/Polyhouse, plastic-non plastic low tunnels, plastic walk in tunnels,high roof tunnels with ventilation, insect proof net houses,rain shelters,NVP.	1.Understand the classification of Protected structures. 2.Understand about installation of drip irrigation and fertigation systems.

		2.2 Climate control greenhouses, hydroponics and aeroponics. **2.3** Soil and soilless media for bed preparation, design and installation of drip irrigation and fertigation systems.	

SW-2 Suggested Seasonal Work (SW):

a Assignments:

i Types of Protected structures in vegetable crops.

B Mini Project

1. Prepare chart of different media used in Protected structures.

VSC 507.3: Student should demonstrate the effect of different environmental factors and it's manipulation for cultivation of vegetable crops.

Approximate Hours

Item	AppXHrs
Cl	03
LI	02
SW	01
SL	02
Total	08

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO3.1 Understand effect of environmental factors in Protected structures. **SO3.2**Determine the manipulation of different Abiotic factors in Protected structures. **SO3.3** Understand effect of environmental factors on growth and yield of different Vegetables.	1.Manipulation of environmental factors in Protected structures.	**Unit-3** Abiotic factors- Effect of environmental factors and manipulation of temperature, light, carbon dioxide, humidity, etc. on growth and yield of different vegetables**.** 3.1Effect of environmental factors in Protected structures. 3.2 Manipulation of environmental factors in Protected structures. 3.3 Effect of environmental factors on growth and yield of different Vegetables.	1.Importance of environmental factors in Protected structures. 2.Learn manipulation of environmental factors in Protected structures.

SW-3 Suggested Sessional Work (SW):

a Assignments:

1. Preparation of Chart showing Environmental factors in Protected structures.

VSC 507.4: Students understand the concepts of nursery raising techniques i.e. Hi- Tech vegetable production in protected structures by using different types of media.

Approximate Hours

Item	App X Hrs
Cl	03
LI	04
SW	03
SL	02
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO4.1 Definition of Nursery and Hi-Tech nursery raising using plugs and potrays in Protected structures. **SO4.2** Different media for growing nursery under Protected structures. **SO4.3** Nursery problems and management technologies including fertigation.	1.Study of fertigation and nutrient management under protected structures. 2. Study of insects, pests and diseases in greenhouse and it's control.	**Unit-4.0:** Nursery raising-High tech vegetable nursery raising in protected structures using plugs and portrays, different media for growing nursery under protected cultivation; Nursery problems and management technologies including fertigation. 4.1Introduction about Hi - Tech vegetable nursery raising in Protected structures. 4.2 Understand different media for growing nursery under Protected structures. 4.3 Different nursery problems and it's management techniques including fertigation.	**1.**Different Problems related to nursery raising in Protected structures 2. Different Growing media for growing nursery in Protected structures.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

i. Role of different media for growing nursery in Protected structures.

b. Mini Projects:

i. Preparation of chart showing different diseases, insects and pests in Protected structures .

2. Other Activities (Specify):

i. Visit to Commercial Nursery, Orchard and Greenhouses/Playhouses.

VSC507.5 Students understand the various cultivation practices of Vegetables in Protected structures.

Approximate Hours

Item	App X Hrs
Cl	02
LI	04
SW	02
SL	01
Total	09

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO5 .1 Understand Regulations of flowering and fruiting in vegetable crops. **SO5.2** Different technology for raising tomato, sweet pepper, cucumber and other vegetables in Protected structures and their remedies. **SO5.3** Staking practices.	5.1 Uses of Protected structures in hybrid seed production of vegetables. 5.2 Practices of staking in Protected structures.	**Unit5:** Cultivation of crops-Regulation of flowering and fruiting in vegetable crops; Technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures, including varieties and hybrids, training, pruning and staking in growing vegetables under protected structures. 5.1. Understand Regulations of flowering and fruiting of vegetables under Protected structures. 5.2. Technology for raising tomato sweet pepper, cucumber and other vegetable in Protected structures.	1.Use of Protected structures in hybrid seed production of vegetables.

SW-5 Suggested Sessional Work (SW):

a Assignments:

v. i Role of staking practices in vegetable crops.

b Mini Projects:

2 Prepare chart showing training and pruning in Greenhouses under Protected structures.

VSC507.6 Students understand the concepts of various problems related to Protected structures and Economics of Greenhouses.

Approximate Hours

Item	App X Hrs
Cl	03
LI	04
SW	02
SL	02
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
SO6 .1 Understand the problems of growing vegetables under Protected structures. **SO6.2** Understand different problems related to vegetable cultivation under Protected structures. SO6.3 Understand the Physiological disorders of different Vegetables under Protected structures. SO6.4Understand Seed production in Protected structures and Economics of Greenhouse crop production.	6.1Practice of Protected structures in hybrid seed production of vegetables. 6.2 Practice of understanding economics of vegetable crops.	**Unit5:** *Solutions to problems*-Problems of growing vegetables in protected structures and their remedies, physiological disorders, insect and disease management in protected structures; Use of protected structures for seed production; Economics of greenhouse crop production. 5.1 Concepts of Problems related to Vegetable cultivation in Protected structures and their remedies. 5.2 Physiological disorders, insects and disease management in Protected structures. 5.3 Use of Protected structure in hybrid seed production of Vegetables and economics of greenhouses.	1. Identify the different diseases and insect, pests in Protected structures. 2.Different physiological disorders related to Protected structures.

SW-5 Suggested Sessional Work (SW):

a Assignments:

i Preparation of chart showing different problems in Protected structures.

b Mini Projects:

1 Prepare chart showing Different physiological disorders under Protected structures.

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)
VSC 507.1: To recall the scope and importance of Protected cultivation, it's Principles, design and orientation.	7	2	2	11
VSC 507.2: Students should understand different types of Protected structures for cultivation of Vegetables.	9	2	2	13
VSC 507.3: Students should demonstrate the effect of different environmental factors and it's manipulation for cultivation of Vegetable crops.	5	1	2	8
VSC 507.4: Students understand the concepts of Nursery raising techniques i.e .High- Tech vegetable production in Protected structures by using different types of media.	7	3	2	12
VSV510.5: Students understand the various cultivation practices of Vegetables in Protected structures.	6	2	1	9
VSC507.6: Students Understand the Concepts of various problems related to Protected structures and Economics of Greenhouses.	7	2	2	11
Total	**41`**	**12**	**11**	**64**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Recall the scope and importance of Protected cultivation, it's Principles and, design and orientation.	3	3	4	10
CO 2	Different types of Protected structures for cultivation of vegetable crops.	4	3	3	10
CO 3	Different environmental factors and it's manipulation for cultivation of vegetables.	0	0	10	10
CO 4	Concepts of nursery raising techniques i.e.High - Tech vegetable production in Protected structures.	4	2	4	10
CO 5	Concepts of various problems related to Protected structures and Economics of Greenhouses.	5	3	2	10
CO 6	Understand the concept of different cultivation practices of vegetable cross under protector structure.	3	3	4	10

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

The end of semester assessment for **Protected cultivation of vegetable 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:

a. Improved Lecture
b. Tutorial
c. Case Method
d. Group Discussion
e. Role Play
f. Demonstration
g. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
h. Brainstorming

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Minor vegetables-untapped -Potential	Bhat, KL	Kalyani Publishers, New Delhi.	2001.
2	Handbook of vegetables.	Peter, KV and Hazra, P	Stadium Press LLC.	2012.
3	Handbook of vegetables volume II &III	Peter, KV and Hazra, P	Stadium Press LLC	2015.
4	Vegetable crop science	Rana, MK	Press Taylor and Francis group.	2018.
5	Advances in Horticulture volsv-x	Chadha, KL and Kallo, G	Malhotra Publishing house.	1993-1994.
6	Handbook of Horticulture	Chadha, KL	ICAR publication	2002.
7	Vegetable crops.	TR, Gopalkrishnan.	New India publ. agency.	2007.
8	Vegetable crops production technology vol. II	MS, Fageria, Chaudhary, BR and Dhaka, RS	Kalyani Publisher, New Delhi	2000.

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Cos, POs and PSOs Mapping
Course Code: VSC 507
Course Title: - Protected cultivation of Vegetable crops

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interior scaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 507.1 To recall the scope and importance of protected cultivation, it's	3	3	2	3	3	1	1	3	3	3	3	3	2	1	1	1	1	1

Principles, design and orientation.																		
VSC 507.2 Students should understand different types of protected structures for cultivation of vegetable crops.	2	3	1	3	2	1	1	2	3	2	3	2	3	1	1	1	1	1
VSC 507.3 Student should demonstrate the effect of different environmental factors and it's manipulation for cultivation of vegetable crops.	2	2	2	2	3	1	1	3	2	3	2	3	2	1	1	1	1	1
VSC 507.4 Students understand the concepts of	3	2	2	3	2	1	1	3	3	2	3	3	2	1	1	1	1	1

nursery raising techniques i.e.Hi-Tech vegetable production in protected structures by using different types of media.																		
VSC 507.5 Students understand the various cultivation practices of Vegetables in Protected structures	2	3	2	3	2	1	1	2	2	2	2	2	3	1	1	1	1	1
VSC 507.6 Students understand the concepts of various problems related to Protected structures and Economics of Greenhouses.																		

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Protected cultivation of Vegetable crops

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 507.CO 1: To To recall the scope and importance of protected cultivation, it's Principles, design and orientation.	**SO1.1** **SO1.2** **SO1.3**	1.1 Principles and Methods of Protected structures. 1.2 Identification of various types of Protected structures.	**Unit-1.0** *Scope and importance*- Concept, scope and importance of protected cultivation of vegetable crops; Principles, design, orientation of structure, low and high cost polyhouses/ greenhouse structures. 1.1, 1.2, 1.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 507.CO 2: Students should understand different types of protected structures for cultivation of vegetable crops.	**SO2.1** **SO2.2** **SO2.3** **SO2.4**	2.1 **1**Practice of Classifying various Protected structures. 2. Using different growing media in Protected structures. 2.3 Practices of installation of drip irrigation and fertigation systems.	**Unit-2.0 –** *Types of protected structure*- Classification and types of protected structures- greenhouse/ polyhouses, plastic-non plastic low tunnels, plastic walk in tunnels, high roof tunnels with ventilation, insect proof net houses, shed net houses, rain shelters, NVP, climate control greenhouses, hydroponics and aeroponics; Soil and soilless media for bed preparation; Design and installation of drip irrigation and fertigation system. 2.1, 2.2, 2.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 507.CO 3: Student should demonstrate the effect of different environmental factors and it's manipulation for cultivation of vegetable crops.	**SO3.1** **SO3.2** **SO3.3**	3.1. Manipulation of environmental factors in Protected structures.	**Unit-3.0** *Abiotic factors*- Effect of environmental factors and manipulation of temperature, light, carbon dioxide, humidity, etc. on growth and yield of different vegetables. 3.1, 3.2, 3.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 507.CO 4: Students understand the concepts of nursery raising techniques i.e.Hi-Tech vegetable production in protected structures by using different types of media.	**SO4.1** **SO4.2** **SO4.3**	4.1 Study of fertigation and nutrient management under protected structures. 4.2 Study of insects,pests and diseases in greenhouse and it's control.	**Unit-4.0** *Nursery raising*- High tech vegetable nursery raising in protected structures using plugs and portrays, different media for growing nursery under protected cultivation; Nursery problems and management technologies including fertigation. 4.1, 4.2, 4.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 507.CO 5: Students understand the various cultivation practices of Vegetables in Protected structures.	**SO5.1** **SO5.2** **SO5.3**	5.1 Uses of Protected structures in hybrid seed production of vegetables. 5.2 Practices of staking	**Unit-5.0** *Cultivation of crops*- Regulation of flowering and fruiting in vegetable crops; Technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures, including	As mentioned in page number ……

			in Protected structures.	varieties and hybrids, training, pruning and staking in growing vegetables under protected structures. 5.1, 5.2.	
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 507.CO 6: Students understand the concepts of various problems related to Protected structures and Economics of Greenhouses.	**SO5.1** **SO5.2** **SO5.3** **SO5.4**	6.1 Practice of Protected structures in hybrid seed production of vegetables. 6.2 Practice of understanding economics of vegetable crops.	**Unit-6.0** *Solutions to problems*- Problems of growing vegetables in protected structures and their remedies, physiological disorders, insect and disease management in protected structures; Use of protected structures for seed production; Economics of greenhouse crop production. 6.1, 6.2, 6.3	As mentioned in page number ……

Semester- II

Course Code: **VSC- 509**

Course Title: **Production of Underutilized Vegetable Crops**

Pre- requisite: To impart knowledge about production technology of lesser utilized vegetable crops

Rationale: With increasing population and fast depletion of natural resources, it has become essential to explore the possibilities of using newer indigenous plant resources. Underutilized crops are plant species that are used traditionally by the country people for their food, fibre, fodder, oil, or medicinal properties but have yet to be adopted by large scale agriculturalists. In general, underutilized plants constitute those plant species that occur as life support species in extreme environmental conditions and threatened habitats, having genetic tolerance to survive under harsh conditions and possess qualities of nutritional and/ or industrial importance for a variety of purposes. Underutilized crops are those plant species with under-exploited potential for contributing to food security, health (nutritional or medicinal), income generation and environmental services. Once the underutilized food crops are properly utilized, they may help to contribute in food security, nutrition, health, income generation and environmental services. The underutilized crops can be defined as the crops, which being region specific are less available, less utilized or rarely used. These underutilized crop species have also been described as rare, minor, orphan, promising and little-used vegetable crops. The students of vegetable science need to have an understanding of production technology of underutilized vegetable crops.

Course Outcomes:

VSC 509.1: To Understand the Production technology of stem and bulb crops.

VSC 509.2: Ability to know the package and practices of cole and salad crops.

VSC 509.3: Student able to know the scientific production of leafy vegetables.

VSC 509.4: Understand the Package of practices gourds and melons.

VSC 509.5: To elaborates the Production of Yam and beans crops.

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)	VSC 509	Production of Underutilized Vegetable Crops	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

Board of Study	Cou se Cod e	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 Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
	VSC 509	Production of Underutilized Vegetable Crops	15	30	0	0	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.

VSC 509.1: To Understand the Production of Stem and bulb crops.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**04**
SL	**02**
Total	**18**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 Understand about the Importance and scope, botany and taxonomy of Underutilized Vegetable Crops like Asparagus **SO1.2** Application of production Underutilized Vegetable Crops Asparagus. **SO1.3** Understand Importance and scope, botany and taxonomy, climate and soil requirement of leek. **SO1.4** Introduces the Package of practices of leek. SO1.5 Ability to understand the scientific cultivation of chinese chive **SO1.6** Understand the plant protection measures and post harvest management of chinese chive.	1. To study the Identification of Underutilized Vegetable Crops and varieties 2. To study the botanical description of Underutilized Vegetable Crops and varieties 3. To study of Seed/ planting material.	**Unit- 1 Stem and bulb crops—Asparagus, leek and chinese chive.** 1.1 Importance and scope, botany and taxonomy of Asparagus 1.2 Production Underutilized Vegetable Crops Asparagus. 1.3 Importance and scope, botany and taxonomy, climate and soil requirement of leek. 1.4 Package of practices of leek. 1.5 scientific cultivation of chinese chive. 1.6 plant protection measures and post harvest management of chinese chive.	1. Improved varieties of Stem and bulb crops. 2. Improved cultural practices, physiological disorders of Stem and bulb crops.

SW-1 Suggested Sessional Work (SW):

u. Assignments:

xiv. Production technology of Stem crops.

xv. Production technology of bulb crops.

v. Mini Project:

viii. Varietal description of Stem and bulb crops.

ix. Botanical description and taxonomy of Stem and bulb crops.

VSC 509.2: Ability to know the package and practices of Cole and salad crops.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**03**
SL	**02**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 2.1. Understand the nutritional importance, origin and distribution, botany and taxonomy of Cole and salad crops. **SO 2.2.** Understand the Commercial varieties/ hybrid varieties classification of Cole and salad crops. **SO 2.3.** Application of package and practices of Red cabbage, chinese cabbage **SO 2.4.** Ability to Understand the production technology of underutilized vegetable crops like kale, sweet corn and baby corn. **SO 2.5.** Understand the Post-harvest management (grading, packaging and marketing) of Cole and salad crops. **SO2.6**. Introduce the physiological disorders, harvesting, yield and plant protection measures of underutilized vegetable crops	1. To study Production, of underutilized vegetable crops. 2. Demonstration on methods of planting of underutilized vegetable crops. 3. To study the lay out underutilized vegetable crops.	**Unit II** ***Cole and salad crops*—Red cabbage, chinese cabbage, kale, sweet corn and baby corn.** 2.1. Nutritional importance, origin and distribution, botany and taxonomy of Cole and salad crops. 2.2 Commercial varieties/ hybrid varieties classification of Cole and salad crops. 2.3 Package and practices of Red cabbage, chinese cabbage. 2.4 Production technology of kale, sweet corn and baby corn. 2.5 Post-harvest management (grading, packaging and marketing) of Cole and salad crops. 2.6 physiological disorders, harvesting, yield and plant protection measures of underutilized vegetable crops.	9. Improved varieties of Cole and salad crops. **10.** Physiological disorders of Cole and salad crops.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

10. Package of Practices of Red cabbage, chinese cabbage

11. Package of Practices of kale, sweet corn and baby corn

b. Mini Project:

6. Flow chart of botanical description of cole and salad crops.

VSC 509.3: Student able to know the scientific production of Leafy vegetables.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**02**
SL	**02**
Total	**16**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO 3.1 Understand the importance, origin and distribution, botany and taxonomy, climate and soil requirement of leafy vegetables. **SO3.2** Ability to understand Improved and hybrid varieties of Leafy vegetables. **SO3.3** Application of Production technology of underutilized vegetable crops like Indian spinach (poi), spinach, chenopods, chekurmanis. **SO3.4** Application of Production technology of underutilized vegetable crops like indigenous vegetables of regional. **SO3.5** Understand the improved cultural practices, physiological disorders, harvesting and yield of Leafy vegetables. **SO3.6** Understand about the plant protection measures and post harvest management of Leafy vegetables.	1. To study the Important cultural operations in Indian spinach (poi) and spinach. 2. To study the Important cultural operations in chenopods and chekurmanis. 3. To study the Important cultural operations in indigenous vegetables.	**Unit III Leafy vegetables— Celery, parsley, Indian spinach (poi), spinach, chenopods, chekurmanis and indigenous vegetables of regional importance.** 3.1. Importance, origin and distribution, botany and taxonomy, climate and soil requirement of leafy vegetables. 3.2 Improved and hybrid varieties of Leafy vegetables. 3.3 Production technology of underutilized vegetable crops like Indian spinach (poi), spinach, chenopods, chekurmanis. 3.4 Production technology of underutilized vegetable crops like indigenous vegetables of regional. 3.5 improved cultural practices, physiological disorders, harvesting and yield of Leafy vegetables. 3.6 Plant protection measures and post harvest management of Leafy vegetables.	7. Enlist the Improved varieties of Leafy vegetables. 8. Post harvest handling of Leafy vegetables.

SW-3 Suggested Sessional Work (SW):

r. Assignments:

Enlist the various physiological disorders of Leafy vegetables

Package of practices chenopods and check our manis

s. Mini Project:

NA.

VSC 509.4: Understand the Package of practices Gourds and melons.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**03**
SL	**02**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Understand the importance, origin and distribution, botany and taxonomy, climate and soil requirement of Gourds and melons. **SO4.2** Ability to understand Improved and hybrid varieties of Gourds and melons. **SO4.3** Application of Package and practices of underutilized vegetable crops like Sweet gourd, spine gourd, teasle gourd and round gourd. **SO4.4** Application of Package and practices of underutilized vegetable crops like snake gourd, pointed gourd, kachri, long melon, snap melon and gherkin **SO4.5** Understand the post harvest management of Gourds and melons. **SO4.6** Introduces the integrated pest and disease management of Gourds and melons.	1. Study of Identification of important pests and their control of Sweet gourd, spine gourd, teasle gourd and round gourd. 2. Study of Identification of important pests and their control of long melon, snap melon and gherkin. 3. Study of Identification of diseases and their control of Gourds and melons.	**Unit IV *Gourds and melons*— Sweet gourd, spine gourd, teasle gourd, round gourd, and little/ Ivy gourd, snake gourd, pointed gourd, kachri, long melon, snap melon and gherkin.** 4.1. Importance, origin and distribution, botany and taxonomy, climate and soil requirement of Gourds and melons. 4.2. Improved and hybrid varieties of Gourds and melons. 4.3. Package and practices of underutilized vegetable crops like Sweet gourd, spine gourd, teasle gourd and round gourd. 4.4. Package and practices of underutilized vegetable crops like snake gourd, pointed gourd, kachri, long melon, snap melon and gherkin 4.5. post harvest management of Gourds and melons. 4.6 Integrated pest and disease management of Gourds and melons.	1. Commercial and hybrid varieties of Gourds and melons 2. Package and underutilized vegetable crops Gourds and melons.

SW-4 Suggested Sessional Work (SW):

r. Assignments:

Package and practices of spine gourd, teasle gourd and round gourd

Package and practices of pointed gourd, kachri, long melon, snap melon and gherkin

s. Mini Project:

k. Flowchart of botanical description of Gourds and melons.

VSC 509.5: To elaborates the Production of Yam and beans.

Approximate Hours

Item	Approximate Hours
CI	**06**
LI	**06**
SW	**03**
SL	**02**
Total	**17**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO5.1 Understand the importance, origin and distribution, botany and taxonomy, climate and soil requirement of Yam and beans crops. **SO5.2** Ability to understand Improved and hybrid varieties of Yam and beans crops. **SO5.3**. Application of Production technology underutilized vegetable crops like Elephant foot yam, yam and yam bean. **SO 5.4.** Application of Production technology underutilized vegetable crops like lima bean and winged bean. **SO5.5** Ability to understand improved cultural practices, physiological disorders, harvesting and yield Yam and beans crops. **SO 5.6**. Understand the plant protection measures and post harvest management of Yam and beans crops.	8. Studies on Maturity standards of and Yam and beans crops 9. To Study of harvesting of Yam and beans crops. 10. Visit to local farms	**Unit V *Yam and beans*— Elephant foot yam, yam, yam bean, lima bean and winged bean.** 1.11. Importance, origin and distribution, botany and taxonomy, climate and soil requirement of Yam and beans crops. 1.12. Improved and hybrid varieties of Yam and beans. 1.13. Production technology underutilized vegetable crops like Elephant foot yam, yam and yam bean. 1.14. Production technology underutilized vegetable crops like lima bean and winged bean. 1.15. Improved cultural practices, physiological disorders, harvesting and yield Yam and beans crops. 1.16. Plant protection measures and post harvest management of Yam and beans crops.	7. Enlist the Improved varieties of Yam and beans crops. 8. Nutritional importance of Yam and beans crops.

SW-5 Suggested Sessional Work (SW):

a. Assignments:

Package of practices of Elephant foot yam and yam bean.

Package of practices of lima bean and winged bean.

b. Mini Project:

i. Flowchart of botanical description of Yam and beans corps.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
VSC 509.1: To Understand the Production technology of Stem and bulb crops.	12	04	02	18
VSC 509.2: Ability to know the package and practices of Cole and salad crops.	12	03	02	17
VSC 509.3: Student able to know the scientific production technology of Leafy vegetables.	12	02	02	16
VSC 509.4: Understand the Package of practices Gourds and melons.	12	03	02	17
VSC 509.5: To elaborates the Production technology of Yam and beans crops.	12	03	02	17
Total	**60**	**15**	**10**	**85**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	Stem and bulb crops—Asparagus, leek and chinese chive.	03	04	03	**10**
CO 2	*Cole and salad crops*—Red cabbage, chinese cabbage, kale, sweet corn and baby corn.	02	02	06	**10**
CO 3	Leafy vegetables—Celery, parsley, Indian spinach (poi), spinach, chenopods, chekurmanis and indigenous vegetables of regional importance.	03	03	04	**10**
CO 4	Gourds and melons—Sweet gourd, spine gourd, teasle gourd, round gourd, and little/ Ivy gourd, snake gourd, pointed gourd, kachri, long melon, snap melon and gherkin.	04	02	04	**10**
CO 5	*Yam and beans*—Elephant foot yam, yam, yam bean, lima bean and winged bean.	03	03	04	**10**
	Total	**15**	**14**	**21**	**50**

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

The end of semester assessment for **Production of Underutilized Vegetable 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
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	Minor vegetables-untapped potential	Bhat KL.	Kalyani publishers, New Delhi.	2001
2	Underexploited tropical vegetables	Indira P and Peter KV.	Kerala agricultural university, Kerala.	1984
3	Aquatic vegetables	Pandey AK.	Agrotech publisher academy, New Delhi	2011
4	Underutilized and underexploited horticultural crops	Peter KV.	New India publishing agency, Lucknow	2007-2008
5	Hand book of vegetables	Peter KV and Hazra P.	Studium Press LLC	2011
6	Hand book of vegetables	Peter KV and Hazra P.	Studium Press LLC	2015
7	Vegetable crop science	Rana MK	CRC Press Taylor and Francis Group	2018
8	World vegetables: vegetable crops	Rubatzky VE and Yamaguchi M.	NBPGR, New Delhi	1997

Curriculum Development Team:

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3. Dr. Abhishek Singh, HOD, Dept. of Horticulture, Faculty of Agriculture Science and Technology AKS University.
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Course Outcomes	Programme Outcomes				Programme Specific Outcomes			
	PO 1	**PO 2**	**PO-3**	**PO-4**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO-4**
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables.	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will identify different cool season, warm season and underutilized vegetable crops.	Student will practice different breeding techniques used in vegetable and flower production.	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post harvest-handling methods for vegetables and flowers.
VSC 509.1: To Understand the Production technology of Stem and bulb crops.	2	1	2	2	3	2	3	3
VSC 509.2: Ability to know the package and practices of Cole and salad crops.	2	1	2	2	3	1	3	3
VSC 509.3: Student able to know the scientific production technology of Leafy vegetables.	1	2	2	2	3	2	2	2
VSC 509.4: Understand the Package of practices Gourds and melons.	1	2	2	2	3	2	3	3
VSC 509.5: To elaborates the Production technology of Yam and beans crops.	2	1	2	2	3	2	3	3

Legend: 1- Low,2 – Medium, 3- High

Semester- III

Course Code: VSC 591

Course Title: Master Seminar

Pre- requisite: Students should have knowledge about basic and futuristic technologies subjected to ICT technology and vegetable science.

Rationale: Student will become familiar with fundamental application of ICT technologies related with vegetable science that will support students in their career skills and leadership development in order to shape tomorrow's social and educational development in Vegetable Science sector.

Course Outcomes:

VSC 591.1. Students will design professional orientation on the topic with their choice of interest which will helps in development of academic and social sector pertaining to vegetable science.

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	
	VSC 591	**Master Seminar**	0	2	1	1	4	(0+1) = 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.

Bord 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 number3 marks each (CA)	Class Test 2(2 best out of3)10 marks each (CT)	Seminar one	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+ CAT+AT)		
	VSC 591	**Master Seminar**	0	0	0	0	0	0	100	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 show case their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

VSC 591.1. Students will design professional orientation on the topic with their choice of interest which will helps in development of academic and social sector pertaining to vegetable science.

Approximate Hours

Item	Approximate Hours
CI	**0**
LI	**30**
SW	**0**
SL	**2**
Total	**32**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 The research seminar allows students to work with ICT technologies in Vegetable Science. **SO1.2.** Research seminar helps the students to refine their skills and knowledge of the subject. **SO1.3.** Research seminar develop vocational qualities in students.	**1.** Selection of topic and collection of presentation materials by using the ICT tools related to the vegetable science on selected topic. **2.** Presentation of acquired material in PPT form.		**1.**Finding the topic related material. **2.**Preparation of PPT related to concerned topic.

SW-1 Suggested Sessional Work (SW):

- **w. Assignments:**
- **x. Mini Project:**
- **y. 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)
VSC 591.1. Students will design professional orientation on the topic with their choice of interest which will helps in development of academic and social sector pertaining to vegetable science.	**30**	**0**	**2**	**32**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Students will design professional orientation on the topic with their choice of interest which will helps in development of academic and social sector pertaining to vegetable science.**	**20**	**40**	**40**	**100**

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

The end of semester assessment for **Master Seminar** will be 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. Group Discussion
3. Demonstration
4. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
5. Brainstorming
6. Smart board

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Research publications			
2	Science direct			
3	Research gate			
4	Pubmade			
5	Academia			
6	Multi authored books			
7	Book chapters			
8	As per directions of course instructor.			

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Cos, POs and PSOs Mapping
Course Code: VSC 591
Course Title: - Master Seminar

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC 591.1 Students will design professional orientation on the topic with their choice of interest which will helps	3	3	2	3	3	1	1	3	3	3	3	3	2	1	1	1	1	1

in development of academic and social sector pertaining to vegetable science.																		

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Master Seminar

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC 591.CO 1: Students will design professional orientation on the topic with their choice of interest which will helps in development of academic and social sector pertaining to vegetable science.	**SO1.1** **SO1.2** **SO1.3**	1.1 Selection of topic and collection of presentation materials by using the ICT tools related to the vegetable science on selected topic. 1.2 Presentation of acquired material in PPT form.	**Unit-1.0**	As mentioned in page number ……

Semester-III

Course Code: - PGS 505

Course Title: - Agricultural Research, Research Ethics and Rural Development Programmes

Pre requisite: -Student should have basic knowledge of agricultural research, research ethics, and agricultural history along with fellowship program, rural development programme.

Rationale: - The students studying agricultural research and research ethics should possess understanding about method of research application, research ethics and fellowship for research and other scholars in construction agricultural development. This encompasses familiarity with the invention and evolution of agricultural research and development of agricultural programme, students ought to acquire fundamental insights into various agricultural technologies, their applications, as well as the Indian needs in agricultural developments.

Course Outcomes:

PGS 505 CO 1: Identify the history, levels of research, economic and social welfare through research programme.
PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.
PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.
PGS 505 CO 4**:** Analyze the various development programmes and their functioning with its impact on agricultural development
PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.

Scheme of studies

Categories of course	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			C l	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Non credit course (NCC)	**PGS 505**	Agricultural Research, Research Ethics and Rural Development Programmes	01	00	02	01	04	01

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:

Categories of course	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 Test 2 (2 best out of 3) 10 marks each (CT)**	**Seminar one (SA)**	**Class Activity any one (CAT)**	**Class Attendance (AT)**	**Total Marks (CA+CT+SA+CAT+AT)**		
(NCC)	**PGS 505**	Agricultural Research, Research Ethics and Rural Development Programmes	15	30	00	00	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.

PGS 505 CO-1 Identify the history, levels of research, economic and social welfare through research programme

Approximate Hours

Item	App X Hrs
C l	3
LI	0
SW	1
SL	1
Total	05

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1- Introduce about the history of agriculture in brief **SO1.2** - Brief the basic concept global agricultural research system. **SO1.3 - Discuss** about the need, scope, opportunities; Role in promoting food security of global agricultural research system. **SO1.4-** Describes the reducing poverty and protecting the environment through global agricultural research system **SO1.5** Asses the functions and use of national Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions.		**Unit-I** History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; **1.1-** History of agriculture in brief **1.2-**Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment **1.3-** National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions	**1.1-** Prepare the assignment on Global agricultural research system

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Global agricultural research system

PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.

Approximate Hours

Item	App X Hrs
C l	3
LI	0
SW	1
SL	1
Total	05

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 – introduce to the Consultative Group on International Agricultural Research (CGIAR) **SO2.2 –** learned about the International Agricultural Research Centers (IARC), **SO2.3-** Briefing the partnership with NARS, role as a partner in the global agricultural research system **SO2.4-** Briefing the strengthening capacities at national levels; International fellowships for scientific mobility **SO 2.5–**Discuss to the strengthening capacities at regional levels; International fellowships for scientific mobility		Unit-II Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility **2.1 -** Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (IARC) **2.2-** Partnership with NARS, role as a partner in the global agricultural research system. **2.3-,** Strengthening capacities at national and regional levels; International fellowships for scientific mobility.	**2.1 –** Prepare the assignment on partnership with NARS, role as a partner in the global agricultural research system

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on partnership with NARS, role as a partner in the global agricultural research system.

PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.

Approximate Hours

Item	App X Hrs
C l	3
LI	0
SW	1
SL	1
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1 – Identify to the Research ethics **SO3.2 –** Discuss to the research integrity, research safety in laboratories **SO3.3-** Apply the welfare of animals used in research **SO3.4-**Discuss to computer ethics and standards **SO3.5**–Describe the problems in research ethics	**LE3.1**	Unit-3 Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics **3.1-**Research ethic and research integrity **3.2-** Research safety in laboratories, welfare of animals used in research. **3.3-** Computer ethics, standards and problems in research ethics.	**3.1** Prepare the assignment on Research ethic and research integrity.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Research ethic and research integrity

b. Mini Project:

c. Other Activities (Specify):

PGS 505 CO 4: Analyze the various development programmes and their functioning with its impact on agricultural development

Approximate Hours

Item	App X Hrs
Cl	3
LI	0
SW	2
SL	1
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1 –Identify the Concept and connotations of rural development. **SO1.2** Apply the rural development policies and strategies **SO1.3-** Asses the Rural development programmes: Community Development Programme, Intensive Agricultural District Programme. **SO1.4-** Describes the Special group – Area Specific Programme. **SO1.5**– Brief the Integrated Rural Development Programme (IRDP)	**LE1.1 -**	Unit-4.0 - I Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) **4.1-** Concept and connotations of rural development, rural development policies and strategies **4.2-** Rural development programmes: Community Development Programme, Intensive Agricultural District Programme **4.3-** Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP)	**1.1-** Prepare the assignment on Community Development Programme.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Community Development Programme

b. Mini Project: Prepare a project report of leadership styles and influence process; leadership theories, leadership styles and effective leader

c. Other Activities (Specify):

PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.

Approximate Hours

Item	App X Hrs
Cl	03
LI	00
SW	01
SL	01
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self-Learning (SL)**
SO1.1– Indentify Panchayati Raj Institutions and Co-operatives. **SO1.2-** Identify the Voluntary Agencies **SO1.3-** Identify the Non-Governmental Organisations **SO1.4-** Discuss the , Critical evaluation of rural development policies **SO1.5-** Briefs the programmes. Constraints in implementation of rural policies and programmes		Unit-5.0 Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes 5.1- Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations **5.2-** Critical evaluation of rural development policies and programmes **5.3-** Constraints in implementation of rural policies and programmes	**1.1** - Prepare the assignment on Panchayati Raj Institutions,

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Panchayati Raj Institutions,

b. Mini Project:

c. Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	**Class Lecture (C l)**	**Laboratory Lecture (L I)**	**Sessional Work (SW)**	**Self-Learning (S l)**	**Total hour (C l + LI+ SW +S l)**
PGS 505 CO-1 Identify the history, levels of research, economic and social welfare through research programme	3	0	1	1	05
PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.	3	0	1	1	05
PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.	3	0	1	1	05
PGS 505 CO 4: Analyze the various development programmes and their functioning with its impact on agricultural development	3	0	2	1	06
PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.	3	0	1	1	08
Total Hours	**15**	**00**	**06**	**05**	**26**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit title	Marks Distribution			Total Marks
		R	U	A	
CO-1	Identify the history, levels of research, economic and social welfare through research programme.	02	03	00	05
CO-2	Apply the functioning, role and significant of regional, national and international research.	02	05	03	10
CO-3	Asses the agricultural research, research ethics with operating and safety of laboratory.	00	08	07	15
CO-4	Analyze the various development programmes and their functioning with its impact on agricultural development.	02	05	08	15
CO-5	Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program	00	03	02	05
	Total	06	24	20	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. Case Method
4. Group Discussion
5. Role Play
6. Visit to Industry
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
01	Indian Agriculture - Four Decades of Development	Bhalla GS & Singh G.	Sage Publ	2001
02	Manual on International Research and Research Ethics	Punia MS	CCS, Haryana Agricultural University, Hisar.	
03	Rural Development Strategies and Role of Institutions Issues, Innovations and Initiatives.	Rao BSV.	Mittal Publ	2007
	Rural Development - Principles, Policies and Management	Singh K.	Sage Publ	1998.

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Cos, POs and PSOs Mapping
Course Code: PGS 505
Course Title: - Agricultural Research, Research Ethics and Rural Development Programmes

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turfgrass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
PGS 505 CO-1 Identify the history, levels of research	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	2

, economic and social welfare through research programme																		
PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	2
PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	2
PGS 505 CO 4: Analyze the various development programmes and their	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	2

functioning with its impact on agricultural development																		
PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Agricultural Research, Research Ethics and Rural Development Programmes

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	PGS 505 CO-1 Identify the history, levels of research, economic and social welfare through research programme	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-1.0** History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions 1.1, 1.2, 1.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-2.0 –** Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility 2.1, 2.2, 2.3.	As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	PGS 505 CO 3: Asses the agricultural research, research ethics	**SO1.1** **SO1.2** **SO1.3**		**Unit-3.0** Research ethics: research integrity, research safety in laboratories, welfare of	As mentioned in page number ……

	with operating and safety of laboratory.	**SO1.4** **SO1.5**		animals used in research, computer ethics, standards and problems in research ethics 3.1, 3.2, 3.3.	
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	PGS 505 CO 4: Analyze the various development programmes and their functioning with its impact on agricultural development	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-4.0** Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) 4.1, 4.2, 4.3.	As mentioned in page number …
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-5.0** Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes 5.1, 5.2, 5.3.	As mentioned in page number …

Semester- III

Course Code: VSC- 599

Course Title: (Research/Thesis)

Pre- requisite: Conduct research to resolving the problem of farmers and society by applying advanced technology adopted in field of Vegetable Science.

Rationale: The basic purpose of master's research is to understand the application of research methodology tools to do research on particular topic related to vegetable science and follow technical writing skill to design the synopsis, thesis.

Course Outcomes:

VSC- 599.1. Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.

VSC- 599.2. Propose research methodology tools for conducting research on selected topic of vegetable science field of horticulture and prepare Final manuscript i.e., Thesis

Scheme of Studies:

Category of course	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
	VSC- 599	**Research/Thesis**	0	30	0	0	30	(0+15) = 15

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e., Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.)

SL: Self Learning,

C: Credits.

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

Category of course	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number3 marks each (CA)	Class Test 2(2 best out of)10 marks each (CT)	Seminar one	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
	VSC- 599	**Research /Thesis**							100	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.

VSC- 599.1. Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.

Approximate Hours

Item	Approx. Hrs
CI	0
LI	30
SW	0
SL	30
Total	60

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO1. Plan the proposal of research related to the topic taken with the help of guide SO2. Design the layout according to topic SO3. Describe the terminology related to the topic SO4. Plan the methodology to conduct the research on the topic SO5. Select the data to be taken during research	**1.1** Submission of research proposal consisting concern programme **1.2** Explain definition of the problems reference to topic **1.3** Explanation of results **1.4** Arrange the references of past work of 10 years **1.5** Collection of data by focusing their objectives and observations to be taken mentioned in their synopsis		**1.**Finding of reviews related with the topic of research. **2.**Preparation of manuscripts related to concerned topic.

VSC- 599.2 Propose research methodology tools for conducting research on selected topic Horticulture

Approximate Hours

Item	Approx. Hrs
CI	0
LI	30
SW	0
SL	30
Total	60

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO1. Choose the topic and objectives for the research SO2. Select the suitable data during the research SO3. Assemble the data taken during the research for interpretation SO4. Arrange the whole work with the interpretate data SO5. Formulate the hypothesis according the final composition.	**1.1** Perform research work as per their topic by using various tools and production technology methods in particular season of crop. **1.2** Collection of data **1.3** Analysis and interpretation of data **1.4** Submission of final thesis based on the research topic		**1.**Finding of reviews related with the topic of research. **2.**Preparation of manuscripts related to concerned topic.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Self - Learning (Sl)	Total hour (Cl+SW+Sl)
VSC- 599.1 Prepare various research activities related to vegetable science field and compose manuscript i.e., synopsis related to particular topic.		**30**	**30**	**60**
VSC- 599.2 Propose research methodology tools for conducting research on selected topic plant pathology		**30**	**30**	**60**
Total		**30**	**30**	**120**

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. Group Discussion
3. Demonstration
4. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Research publications			
2	Science direct			
3	Research gate			
4	Pub made			
5	Academia			
6	Multi authored books			
7	Book chapters			

Curriculum Development Team:

1. Dr. NeerajVerma, PG Coordinator,
2. Dr. Doomar Singh, HoD, Dept. of Plant Pathology
3. Dr. Abhishek Singh, HOD, Dept. of Horticulture
4. Dr. Bharti Sao, Assistant Professor, Dept. of Horticulture
5. Dr. Mohni Parmar, Assistant Professor, Dept. of Horticulture
6. Dr. S. K. Chandel, Assistant Professor, Dept. of Horticulture
7. Mr. Ansul Asre, Teaching Associate, Dept. of Horticulture

Cos, POs and PSOs Mapping
Course Code:-VSC 599
Course Title: - Master's Research (Research/Thesis)

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO1	PSO 2	PSO3	PSO4	PSO5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and under utilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different under utilized vegetable and spice crops	Student will apply different vegetable processing and post - harvest-handling methods for vegetables and flowers	Student will understand role of micro climate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turf grass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC-599.1.Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.	2	2	2	3	2	3	2	3	2	2	1	2	2	1	1	2	2	3
VSC-599.2. Propose research methodolo	2	2	2	1	3	3	2	1	3	3	2	2	2	1	1	1	2	3

gy tools for conducting research on selected topic of vegetable science field of horticultur e and prepare Final manuscript i.e., Thesis																		

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Master Seminar

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC- 599.1. Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1**Submission of research proposal consisting concern programme **1.2** Explain definition of the problems reference to topic **1.3** Explanation of results **1.4** Arrange the references of past work of 10 years **1.5** Collection of data by focusing their objectives and observations to be taken mentioned in their synopsis		As mentioned in page number ……
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC- 599.2. Propose research methodology tools for conducting research on selected topic of vegetable science field of horticulture and prepare Final manuscript i.e., Thesis	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1** Perform research work as per their topic by using various tools and production technology methods in particular season of crop. **1.2** Collection of data **1.3** Analysis and interpretation of data **1.4** Submission of final thesis based on the research topic		As mentioned in page number ……

Semester- IV

Course Code: VSC- 599

Course Title: (Research/Thesis)

Pre- requisite: Conduct research to resolving the problem of farmers and society by applying advanced technology adopted in field of Vegetable Science.

Rationale: The basic purpose of master's research is to understand the application of research methodology tools to do research on particular topic related to vegetable science and follow technical writing skill to design the synopsis, thesis.

Course Outcomes:

VSC- 599.1. Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.

VSC- 599.2. Propose research methodology tools for conducting research on selected topic of vegetable science field of horticulture and prepare Final manuscript i.e., Thesis

Scheme of Studies:

Category of course	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
	VSC- 599	Research/Thesis	0	30	0	0	30	(0+15) = 15

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e., Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.)

SL: Self Learning,

C: Credits.

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

Category of course	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/Home Assignment 5 number3 marks each (CA)	Class Test 2(2 best out of)10 marks each (CT)	Seminar one	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
	VSC- 599	Research /Thesis							100	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.

VSC- 599.1. Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.

Approximate Hours

Item	Approx. Hrs
CI	0
LI	30
SW	0
SL	30
Total	60

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO1. Plan the proposal of research related to the topic taken with the help of guide SO2. Design the layout according to topic SO3. Describe the terminology related to the topic SO4. Plan the methodology to conduct the research on the topic SO5. Select the data to be taken during research	**1.1** Submission of research proposal consisting concern programme **1.2** Explain definition of the problems reference to topic **1.3** Explanation of results **1.4** Arrange the references of past work of 10 years **1.5** Collection of data by focusing their objectives and observations to be taken mentioned in their synopsis		**1.**Finding of reviews related with the topic of research. **2.**Preparation of manuscripts related to concerned topic.

VSC- 599.2 Propose research methodology tools for conducting research on selected topic plant pathology

Approximate Hours

Item	Approx. Hrs
CI	0
LI	30
SW	0
SL	30
Total	60

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self -Learning (SL)
SO1. Choose the topic and objectives for the research SO2. Select the suitable data during the research SO3. Assemble the data taken during the research for interpretation SO4. Arrange the whole work with the interpretate data SO5. Formulate the hypothesis according the final composition.	**1.1** Perform research work as per their topic by using various tools and production technology methods in particular season of crop. **1.2** Collection of data **1.3** Analysis and interpretation of data **1.4** Submission of final thesis based on the research topic		**1.**Finding of reviews related with the topic of research. **2.**Preparation of manuscripts related to concerned topic.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Self - Learning (Sl)	Total hour (Cl+SW+Sl)
VSC- 599.1 Prepare various research activities related to vegetable science field and compose manuscript i.e., synopsis related to particular topic.		**30**	**30**	**60**
VSC- 599.2 Propose research methodology tools for conducting research on selected topic plant pathology		**30**	**30**	**60**
Total		**30**	**30**	**120**

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. Group Discussion
3. Demonstration
4. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Research publications			
2	Science direct			
3	Research gate			
4	Pub made			
5	Academia			
6	Multi authored books			
7	Book chapters			

Curriculum Development Team:

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6. Dr. S. K. Chandel, Assistant Professor, Dept. of Horticulture
7. Mr. Ansul Asre, Teaching Associate, Dept. of Horticulture

Cos, POs and PSOs Mapping
Course Code:-VSC 599
Course Title: - Master's Research (Research/Thesis)

Course Outcomes	PO 1	PO 2	PO-3	PO-4	PO-5	PO-6	PO 7	PSO1	PSO 2	PSO3	PSO4	PSO5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
	Student will identify the current scenario, crop diversity, climatic requirement and breeding techniques of different vegetable and flower crops.	Student will expertise in latest vegetable production technologies, vegetable breeding techniques and post-harvest management of vegetables	The student will have expertise in nursery-raising techniques and protected cultivation of vegetables and flower crops.	The student will have expertise in different climatic conditions required for common vegetable as well as underutilized vegetable cultivation.	Student will plan about the big scale commercial project and also manage the research trails under vegetable and flower crops	Student will apply various statistical methods to analyze their master research work	Student will understand about library techniques, technical writing skill, IPR, laboratory techniques and research ethics in manuscript writing	Student will identify different cool season, warm season and underutilized vegetable crops	Student will practice different breeding techniques used in vegetable and flower production	Student will recognize different underutilized vegetable and spice crops	Student will apply different vegetable processing and post-harvest-handling methods for vegetables and flowers	Student will understand role of microclimate in vegetable and flower crop production under different protected structures	After gaining experience, they will get the positions of specialists for handling plantation, nurseries and other protected cultivation projects	Student will recognize different flower, ornamental crops and their nursery management	Student will practice turfgrass, indoor plant and interioscaping management	Student will apply various information services, technical writings and communication skills in their academics	Student will apply basic concepts in laboratory techniques during their research work	Student will apply basic statistical tools during their research work
VSC-599.1.Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to	2	2	2	3	2	3	2	3	2	2	1	2	2	1	1	2	2	3

particular topic.																		
VSC-599.2. Propose research methodology tools for conducting research on selected topic of vegetable science field of horticulture and prepare Final manuscript i.e., Thesis	2	2	2	1	3	3	2	1	3	3	2	2	2	1	1	1	2	3

Legend: 1- Low,2 – Medium, 3- High

Course Curriculum Map: Master Seminar

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 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC- 599.1. Prepare various research activities related to concern field and compose manuscript i.e., synopsis related to particular topic.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1**Submission of research proposal consisting concern programme **1.2** Explain definition of the problems reference to topic **1.3** Explanation of results **1.4** Arrange the references of past work of 10 years **1.5** Collection of data by focusing their objectives and observations to be taken mentioned in their synopsis		As mentioned in page number …
PO 1,2,3,4,5,6,7 PSO 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11	VSC- 599.2. Propose research methodology tools for conducting research on selected topic of vegetable science field of horticulture and prepare Final manuscript i.e., Thesis	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	**1.1** Perform research work as per their topic by using various tools and production technology methods in particular season of crop. **1.2** Collection of data **1.3** Analysis and interpretation of data **1.4** Submission of final thesis based on the research topic		As mentioned in page number ……