

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(Autonomous & Re-Accredited with 'A' Grade by NAAC)
Chennai – 600 106

SYLLABUS



OUTCOME BASED EDUCATION

2020-2021

B.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

FOR THE CANDIDATES ADMITTED DURING ACADEMIC YEAR 2019

DISTRIBUTION OF CREDITS B.Sc – PLANT BIOLOGY & PLANT BIOTECHNOLOGY

Course component	Name of the course	Allocation of Credit & Hours	
		Credit	Hours/Week
Part I	TAMIL/TELUGU/HINDI/SANSKRIT/ FRENCH Ability Enhancement Compulsory Course (AECC)	3x4=12	22
Part II	ENGLISH Ability Enhancement Compulsory Course (AECC)	3x4=12	20
Part III	Core Course/Practical	67	
Semester I (Subject Name & Credits)	Core Paper -1 : Algae, Fungi & Lichens	05	06
Semester II (Subject Name & Credits)	Core Paper -2: Basics in Microbiology & Plant Pathology	05	06
	Core Paper -3: Practical -I (Algae, Fungi & Lichen, Basics in Microbiology & Plant Pathology)	03	06
Semester III (Subject Name & Credits)	Core Paper -4: Bryophytes & Pteridophytes	05	06
	Skill Enhancement Course (SEC)		
Semester IV (Subject Name & Credits)	Core Paper -5: Gymnosperm, Paleobotany & Evolution)	05	06
	Core Paper -6: Practical -II (Bryophytes & Pteridophytes, Gymnosperm, Paleobotany & Evolution)	03	06
	Skill Enhancement Course (SEC)		
Semester V (Subject Name & Credits)	Core Paper -7: Plant Morphology, Taxonomy & Ec onomic Botany	05	05
	Core Paper -8: Plant Anatomy & Embryology	05	05
	Core Paper -9: Cell Biology & Molecular Biology	05	05
	Core Paper -10: Genetics, Plant Breeding & Biostatistics	05	05
	Skill Enhancement Course (SEC)		
Semester VI (Subject Name & Credits)	Core Paper -11: Plant Ecology & Phytogeography	05	05
	Core Paper -12: Plant Physiology & Plant Biochemistry	05	06

	Core Paper -13: Plant Biotechnology	05	05
	Core Paper -14: Practical –III Covering Core Papers (7,8,9 &10)	03	06
	Core Paper -15: Practical –III Covering Core Papers (11,12,&13)	03	06
	Skill Enhancement Course (SEC)		
Part III	Allied Course/Practicals	20	
Semester I	Allied Paper – 1 Zoology	04	06
Semester II	Allied Paper – 2 Zoology	04	06
	Allied Practical –I (Covering Both Allied paper 1&2)	02	06
Semester III	Allied Paper – 3 Chemistry	04	05
Semester IV	Allied Paper – 4 Chemistry	04	05
	Allied Practical –I (Covering Both Allied paper 3&4)	02	06
Part III	Minimum THREE ELECTIVE PAPERS	3x5 =15	
Discipline Specific Elective	Core Elective Paper -1: (V- Semester) Horticulture & Mushroom Cultivation	04	04
Discipline Specific Elective	Core Elective Paper -2: (VI- Semester) Herbal Science & Ethnobotany	04	04
Discipline Specific Elective	Core Elective Paper -3: (VI- Semester) Microtechnique	04	04
Open Elective	Organic farming/Bioinformatics/ Seaweed Technology	03	02
Internship/Project	An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called Dissertation/Project .		
Part IV	1.BASIC TAMIL/ADVANCED TAMIL/NME	2x2=04	02
	2.SOFTSKILLS	3x4=12	04
	3.ENVIRONMENTAL STUDIES (SEMESTER IV) Ability Enhancement Compulsory Course (AECC)	02	01
	4.VALUE EDUCATION (SEMESTER V)	02	01

Part V	5. EXTENSION ACTIVITY (Semester VI)	01	
	MOOC COURSES/CERTIFICATE COURSES (if any)	02	
	TOTAL	149	182

DEPARTMENT OF BOTANY

VISION

“Exploration of Plants and realize their significance in the entire Ecosystem”

MISSION

M1	To equip the students with an overall knowledge of plant science.
M2	To develop human resource with expertise in skill based areas of plant sciences.
M3	To ignite students with requisite knowledge for lifelong learning and achieve greater heights in the field of research, entrepreneurship and teaching positions in Biological sciences.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The objectives of this Programme is to equip/prepare the students

PEO1	To produce proficient and scholarly undergraduates with strong fundamentals in plant science to pursue higher studies in the field of research, innovation and technology.
PEO2	To enable undergraduates , to develop intellectually through lifelong learning and to pursue their career in their field of specialization or interest
PEO3	To make undergraduates, capable of attainment employment in teaching and industry

The Graduate Attributes of UG programmes are as follows :

- 1) **Knowledge:** Acquire in-depth knowledge of the discipline or profession, including vast global perspective, with an ability to discriminate, evaluate, analyse and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
- 2) **Critical Thinking:** Analyse problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
- 3) **Problem Solving:** Think originally, conceptualize and solve problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
- 4) **Usage of modern tools:** Create, select, learn and apply appropriate techniques, resources, and modern ICT tools.
- 5) **Communication:** Communicate with the relevant community, and with society at large, confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
- 6) **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
- 7) **Ethical Practices and Social Responsibility:** Acquire integrity, code of conduct, ethics of life and an understanding of responsibility to contribute to the community for sustainable development of society.
- 8) **Independent and Reflective Learning:** Observe and examine critically the outcomes of one's actions and make corrective measures subsequently and learn from mistakes without depending on external feedback.

PROGRAMME OUTCOMES

At the completion of the B.Sc. Plant Biology & Plant Biotechnology programme, the students of our Department will be able to:

S.NO	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
1.	Knowledge	Attain in-depth Knowledge in the field of plant and animal diversity in terms of structure, function and environmental relationships. (PO1)
2.	Critical Thinking	Apply the knowledge of biology to make scientific queries and enhance the comprehension potential. (PO2)
3.	Problem Solving	Identify the taxonomic position of plants and animals using principles and methods of nomenclature. Mapping of chromosomes, solving Bio statistical problems and also experiments related to plant physiology (PO3)
4.	Usage of modern tools	Demonstrate practical observation of both internal and external features of plants & animals and experiments using Biological tools and techniques (Like Oil immersion Microscope, Light Microscope, Dissection Microscope, calorimeter, Ganong's potometer) for cellular and fundamental metabolism of plants with an understanding of the application and limitations. (PO4)
5.	Communication	Practice successful transfer of scientific knowledge and biological information both in oral and in writing and also making effective ICT presentations. (PO5)
6.	Life-long Learning	Study incessantly by self to cope with growing competition for higher studies and employment. Enhance the acquired skills for a lifelong learning in the broadest context of technological and social change. (PO6)
7.	Ethical Practices and Social Responsibility	Demonstrate and practice social, environmental and biological ethics. (PO7)
8.	Independent and Reflective Learning	Use of skills in interdisciplinary and multidisciplinary areas of life sciences and its applications and develop a passion to pursue a career in the field of Life science. (PO8)

PROGRAMME SPECIFIC OUTCOMES (PSO)

At the time of graduation Our Graduates will be able to:

PSO1	Evaluate, Analyse and interpret diversity of plant and animal life forms, using specific identification key characteristic features and its significance in structured framework, including critical understanding of the established theories, principles and concepts of a number of advanced and emerging issues in the field of Life sciences.
PSO2	Demonstrate the comprehensive knowledge in various plant and animal structure and functions (both internal & external), physiological metabolism, Gene concepts, genome, cell organelles & tissue culture.
PSO3	Elucidate the knowledge of distribution of plants, herbal medicines, methods of gardening, different habitats and their degradation and analyse the diseases of crop plants and their control measures, study about communicable and non-communicable diseases and health & hygiene.
PSO4	Apply the knowledge of Lifescience to solve complex problem in research labs using the latest biological tools and techniques.
PSO5	Comprehend the latest developments in the field of Life science, both theoretical and practical and also on entrepreneurial development skills in a way to foster their core competency and lifelong learning.

Course Code	Course Title	Category	L	T	P	S	Credits
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16-19/13101	ALGAE, FUNGI & LICHENS	Core paper - I	6				5
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Year	Semester	CIA	ESE	Exam Hours
First	First	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to recognize Habit, life forms and reproductive structures of lower forms of plants. The student will be able to understand the classification of algae and Fungi. The subject also throws light on economic importance of algae, fungi and lichens.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Evaluate in detail about Algal classification and its importance	K1 & K3
CO2	Identify different forms of Algae	K2
CO3	Assess knowledge of fungi with respect to classification and its importance to mankind	K1 & K3
CO4	Identify various life forms of Fungi	K2
CO5	Outline the salient features of Lichens	K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	2	2	2	3	3	2	2	2	3
CO2	3	2	2	3	3	3	2	2	3	3	3	3	2
CO3	3	3	2	2	3	3	3	3	3	2	2	2	3
CO4	3	3	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	3	3	3	3	2	2	3	3	3	3	2

STRONGLY CORRELATED -3; MODERATELY CORRELATED - 2; WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
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1	MODULE – I ALGAE 1.1 Introduction. 1.2 Distribution and General characteristics of major classes 1.3 Thallus organization 1.4 Life cycle patterns 1.5 Economic Importance of Algae 1.6 Classification of Algae -F.E. Fritsch 1945.	20	CO1
2	MODULE – II Life history of the following representative genera of Algae: 2.1. Cyanophyceae – <i>Nostoc</i> 2.2 Chlorophyceae – <i>Volvox</i> , and <i>Caulerpa</i> 2.3 Charophyceae - <i>Chara</i> 2.4 Bacillariophyceae – <i>Navicula</i> 2.5 Phaeophyceae – <i>Sargassum</i> 2.6 Rhodophyceae – <i>Gracillaria</i>	20	CO2
3	MODULE – III FUNGI 3.1 Introduction. 3.2 General characteristics, occurrence, thallus organization, nutrition and reproduction in Fungi. 3.3 Classification of Fungi By Alexopolus 3.4 Economic importance of Fungi.	20	CO3
4	MODULE – IV Life history of the following representative genera of fungi. 4.1 Mastigomycotina - <i>Albugo</i> 4.2 Ascomycotina – <i>Peziza</i> 4.3 Basidiomycotina – <i>Puccinia</i> 4.4 Deuteromycotina – <i>Alternaria</i>	20	CO4
5	MODULE – V LICHENS 5.1 Thallus Organization, 5.2 Types and Reproduction. 5.3 Foliose – life cycle. 5.4 Economic importance lichens.	10	CO5

TEXT BOOKS:

1. Vashishta. B.R. 2010, Botany for Degree Students – Algae, S.Chand & Company, New Delhi.
2. Sharma, O.P, 2010. Algae, McGraw Hill Education, Chennai.
3. Vashishta B.R. and Sinha A.K, 2016, Botany for Degree Students - Fungi, S.Chand & Company, New Delhi.
4. Sharma, O.P. 2010, Fungi, McGraw Hill Education, Chennai.

REFERENCE BOOKS:

1. Fritsch, F.E. 1935. Structure and Reproduction of Algae, Vol. I, Cambridge University Press, Cambridge.
2. Fritsch, F.E. 1945. Structure and Reproduction of Algae, Vol. II, Cambridge University Press, Cambridge.
3. Webster, J. 1970. Introduction to fungi. Cambridge University Press, London
4. C.J. Alexopoulos, C.W. Mims, *et al.*, 2007. Introductory Mycology (4th Ed.), Wiley, New Delhi.

WEBSITES:

<https://www.britannica.com/science/algae>
<https://microbiologyonline.org/about-microbiology/introducing-microbes/fungi>
<https://www.anbg.gov.au/lichen/what-is-lichen.html>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13102	ALLIED ZOOLOGY - I	Allied paper - I	4				4

Year	Semester	CIA	ESE	Exam Hours
First	First	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to recognize Habit, Habitat, Structure and all the systems of animals. The student will be able to understand the classification of animal kingdom including both invertebrate and vertebrates.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Outline the classification of animal kingdom	K1
CO2	Discuss about various parasites that cause diseases in animals	K1 & K3
CO3	Discuss the affinities of amphioxus with other chordates	K2
CO4	Compare the life history of different animals	K1 & K2
CO5	Discuss about various systems of chordates	K1 & K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	2	3	2	3	3	3	2	3	2	2
CO3	3	3	2	2	3	2	2	3	3	2	2	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I INVERTEBRATES 1.1. General characters and Classification. 1.2. Protozoa-Type study: <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> and <i>Paramecium caudatum</i> . 1.3. Porifera - Type study: Scypha (sycon) 1.4. Coelenterate- Type study: <i>Obelia geniculata</i> 1.5. Platyhelminthes- Type study: <i>Fasciola hepatica</i> , <i>Taenia solium</i>	12	CO1
2	MODULE – II 2.1. Annelida- Type study: Leech 2.2. Arthropoda- Type study: Prawn (<i>Penaeus indicus</i>) 2.3. Mollusca- Type study: Fresh water mussel 2.4. Echinodermata- Type study: Sea star	12	CO2
3	MODULE – III 3.1. Prochordates-Amphioxus-Structure and Affinities 3.2. Chordata- General characters & Classification 3.3. Vertebrates-Pisces- Type study: Shark	12	CO3
4	MODULE – IV 4.1 Amphibia-Type study: Frog. Reptilia: Calotes	12	CO4
5	MODULE – V 5.1 Aves- Type study: Pigeon: Mammalia-Type study: Rabbit.	12	CO5

TEXT BOOKS:

1. Jordan EL and Verma PS.2010. Chordate Zoology. S.Chand Publications, New Delhi
2. Jordan EL and Verma PS.2011. Invertebrate Zoology. S.Chand Publications, New Delhi
3. Agarwal V.K. 2011.Zoology for Degree Students B.Sc. First Year. S.Chand Publications, New Delhi

REFERENCE BOOKS:

1. Ekambaranatha Ayyar, M.Ananthkrishnan, T.N.1993, Outlines of zoology, Vol.I and Vol.II, Viswanathan and Co. Madras.
2. Kotpal R.L. 2016. Modern Textbook of Zoology Invertebrates. Rastogi Publications.Uttar Pradesh.

WEBSITES

<https://www.britannica.com/animal/invertebrate>

<https://www.dkfindout.com/us/animals-and-nature/animal-kingdom/what-is-vertebrate/>

http://www.biology4kids.com/files/vert_main.html

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13103	VERMITECHNOLOGY	Part IV: NME -I	2				2

Year	Semester	CIA	ESE	Exam Hours
First	First	40	60	03

LEARNING OBJECTIVES:

On learning this course Students will be able to prepare the vermicompost in a limited space and describe the decomposing process. The students will get the knowledge of vermiculture and production of bio-manure and will get self-employment. They will also turn towards organic farming; will help to maintain pollution free environment. Students will get the knowledge of biodiversity of local earthworms.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Apply vermiculture techniques by using different types of soil	K1
CO2	Discuss the role of local species of earthworm in vermiculture	K1 & K2
CO3	Design a vermicomposting bed	K1, K2 & K3
CO4	Apply the procedure for vermicompost	K3
CO5	Apply the methods to reduce the enemies of earthworms during vermicomposting	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	2	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	2	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	2	3	3	3	2	3	3
CO4	3	3	2	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	2	3	2	2	2	2	2	3	2	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I VERMITECHNOLOGY 1.1 Introduction: Definition and concept of vermiculture. 1.2 Soil: major types (red soil, black soil, alluvial soil). 1.3 Influence of soil organisms in vermitechnology- bacteria, earthworms, entomofauna mites etc. 1.4 Litter degradation and decomposition. 1.5 Problems in vermiculture and remedial solutions.	06	CO1
2	MODULE – II 2.1 Types of earthworms: Endemic and exotic species of earthworms. 2.2 Ecological classification of earthworms- epigeic, anecic and endogeic forms. 2.3 Physical, chemical and biological changes caused by earthworms in soil-drilospheres and vermicasts.	06	CO2
3	MODULE – III 3.1 Vermicomposting- Vermicomposting materials, Vermicomposting methods (raised bed method and pot method). 3.2 Establishment of vermiculture unit: materials required and maintenance of vermiculture unit.	06	CO3
4	MODULE – IV 4.1 Vermicompost- harvesting of vermicompost- quality, properties and advantages over chemical fertilizers, packing and marketing- cost benefit analysis.	06	CO4
5	MODULE – V 5.1 Natural enemies of earthworms- pets, parasites and pathogens affecting earthworms. 5.2 Use of earthworms in food and medicine- ayurvedic and unani medicine. 5.3 Recycling of food wastes in vermitechnology. 5.4 Application and scope of vermitechnology.	06	CO5

TEXT BOOKS:

1. Jordan EL and Verma PS.2011. Invertebrate Zoology. S.Chand Publications, New Delhi
2. Gupta PK.2008.Vermicomposting For Sustainable Agriculture. Agrobios

REFERENCE BOOKS:

1. Subba Rao NS. 1995. Soil Microorganisms and Plant Growth. Science Publishers.
2. Edwards CA.2011 Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management. CRC Press. USA.

WEBSITES:

<https://technology4agri.wordpress.com/2013/02/12/vermitechnology-an-introuction/>

https://vermitechnology.com/vermitechnology/?doing_wp_cron=1574957760.9421699047088623046875

<https://en.wikipedia.org/wiki/Vermicompost>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13204	BASICS IN MICROBIOLOGY AND PLANT PATHOLOGY	Core paper - II	6				5

Year	Semester	CIA	ESE	Exam Hours
First	Second	40	60	03

LEARNING OBJECTIVES:

The course explains the basic concepts, history and development of microbiology. The course content focuses on the classification and biology of microbes - bacteria, viruses, fungi and algae. Elaborate the significance of beneficial microbes and methods for the control of pathogenic microbes.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Evaluate the existence of various microbes and their importance	K2,K3
CO2	Demonstrate usage of various glassware's and ways of microbial isolation	K3
CO3	List out the important usage of microbial products	K1
CO4	Identify various plant pathogens and their positive and negative aspects	K2
CO5	List out various plant diseases and their remedial measures	K1,K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	2	3	3	2	3	3	2	3	3	3
CO4	3	2	3	3	3	3	3	2	3	2	3	3	2
CO5	3	3	3	3	3	3	3	2	3	2	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED - 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I BASICS IN MICROBIOLOGY 1.1 Introduction to Microbial world 1.2 Protozoa 1.3 Bacteria 1.4 Viruses 1.5 Bacteriophages 1.6 Mycophages 1.7 Cyanophages 1.8 Mycoplasma, Viroids and Prions their general structure and multiplication 1.9 Economic Importance of Microbes	20	CO1
2	MODULE – II 2.1 Cleaning and Sterilization of Glasswares, 2.2 Isolation techniques – Pour plate – Spread plate – Streak plate – Serial dilution. 2.3 Media & Types of culture media 2.4 Staining techniques – simple and differential staining. 2.5 Control of microbes – physical, chemical and biological methods.	20	CO2
3	MODULE – III 3.1 Fermentation 3.2 Antibiotic production – <i>Streptomycin</i> . 3.3 Microbiology of air- 3.4 Microbiology of potable water – MPN - techniques 3.5 Food preservation methods.	20	CO3
4	MODULE – IV PLANT PATHOLOGY 4.1 A brief history of plant pathology: 4.2 Principles of plant pathology, 4.3 Symptomatology- 4.4 Study of infection – entry of fungal, viral and bacterial pathogen. 4.5 Host defense (Structural & Biochemical) 4.6 Role of toxins (wild fire & Victorin) and enzymes (Cellulases, Pectinases & Chitinases) in plant pathogenesis. 4.7 Control - Biological (<i>Trichoderma</i> & <i>Pseudomonas</i>)	20	CO4
5	MODULE – V 5.1 Name the causative Organisms etiology and control measures of the following diseases:	10	CO5

a) Paddy blast b) Citrus canker c) Red Rot of Sugarcane d) Tikka disease of groundnut e) Little leaf of Brinjal f) Bunchy top of Banana g) Leaf curl of Papaya		
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TEXT BOOKS:

1. Maheshwari D. K and Dubey R.C. 2013. A Textbook of Microbiology. S. Chand publications. New Delhi.
2. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw Hill Publishing Company Ltd, New Delhi.

REFERENCE BOOKS:

1. Michael Pelczar, Jr. 2001, Microbiology. McGraw Hill Education, New Delhi.
2. Singh, R.S. 1980. Introduction to Principles of Plant Pathology (3rd Ed.) Oxford. IBM. Publishing Co. Pvt. Ltd, New Delhi.

WEBSITES

- <https://www.britannica.com/science/microbiology>
<https://microbiologyonline.org/about-microbiology>
<https://phytopath.ca/education/what-is-plant-pathology/>
http://ceventura.ucanr.edu/Environmental_Horticulture/Landscape/Problems/Pathology/

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20

Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13104	PRACTICAL – I (Algae, Fungi & Lichens, Basics In Microbiology And Plant Pathology)	Core Paper : III			8		4
Year	Semester	CIA	ESE		Exam Hours		
First	First & Second	40	60		03		

LEARNING OBJECTIVES:

On taking this course the student will be able to prepare and identify microslides of Algae, Fungi and Lichens and diseased plant specimens. The student will be able to understand the methodologies involved in cleaning, sterilization, preparation of media and the isolation of microorganisms and natural remedies for pests.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Dissect and prepare micro slides of Algae and Fungi	K3
CO2	Examine the morphological and anatomical features of Algae, fungi & Lichens	K2
CO3	Apply techniques in cleaning and maintenance of glass wares	K3
CO4	Identify and Isolate of microbes from contaminated items	K3
CO5	Identify different plant diseases	K1

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	2	3	3	2	2	3	3	3	2	2	2
CO2	3	3	3	3	3	2	2	2	3	3	2	3	2
CO3	3	3	2	3	3	2	2	3	2	2	2	3	3
CO4	3	3	3	2	3	3	3	3	2	2	2	3	3

CO5	3	2	3	1	2	3	2	3	3	2	3	2	2
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STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Algae , Fungi & Lichen

1. Micropreparation of the types prescribed in the syllabus.
2. Identifying the micro slides relevant to the syllabus.
3. Identifying types of Algal mixture.
4. Morphological study of Algae, Fungi and Lichens.

Microbiology & Plant Pathology

1. Cleaning and Sterilization of Glasswares
2. Preparation of Culture media
3. Isolation of pure culture – Streaking, spread and pour plate method
4. Staining of bacteria : Simple and Gram staining
5. Potability of drinking water – MPN
6. MBRT of Milk
7. Isolation of microbes from spoiled food items
8. Study of the diseases included in theory
9. Section – Tikka diseases of Groundnut
Section - Citrus Canker
Section – Leaf curl of Papaya
10. Biological pesticides – *Trichoderma*, *Bacillus thurengiensis*, Neem cake etc.,

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	Class room Practical's	Record Submission	Attendance
Marks (out of 40)	20	15	5
Remember	5		
Understand	5		
Apply	5	15	
Analyze	5		
Evaluate			
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
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Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13205	ALLIED ZOOLOGY - II	Allied paper - II	4				4

Year	Semester	CIA	ESE	Exam Hours
First	Second	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will list the distinctive features and importance of cell organelles. The student can distinguish between the structure of DNA and RNA. The last part deals with sex determination in animals and genetic disorders arising due to chromosomal mutations.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Discuss various cell organelles	K2
CO2	Understand the concepts associated with genes and their disorders	K2
CO3	Analyze the human physiology process	K1
CO4	Explain the concepts of evolution	K2
CO5	Discuss about importance of culturing techniques of honey bee, silkworm and poultry	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	2	2	2	3	2	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3

CO4	3	2	2	2	3	3	3	2	3	3	2	2	3
CO5	3	3	2	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	<p>MODULE – I CELL BIOLOGY 1.1 Structure of an animal cell, Mitochondria, nucleus and nucleolus and Golgi bodies.</p>	12	CO1
2	<p>MODULE – II GENETICS 2.1 Molecular structure of Gene-Gene concept- Gene function-Inborn errors of metabolism- Genetic Engineering and its applications- X and Y – linked inheritance.</p> <p>DEVELOPMENTAL BIOLOGY 2.2 Gametogenesis – Fertilization- Cleavage and Gastrulation of Chick.</p>	12	CO2
3	<p>MODULE – III HUMAN PHYSIOLOGY: Digestion, Excretion, Osmo-iono regulation, Kidney failure and transplantation. Structure of Heart, Cardiac cycle, composition of blood, Blood pressure, Heart diseases- Ischemia, Myocardial infarction, Rheumatic Heart disease, Stroke. Endocrine glands- Hormones- feedback mechanism- Pituitary, thyroid, Islets of Langerhans, adrenal, sex organs, gastrointestinal hormones.</p>	12	CO3
4	<p>MODULE – IV ENVIRONMENTAL BIOLOGY 4.1 Physico- Chemical factors- Environmental Degradation treatment methods on sewage effluents- Greenhouse effect.</p> <p>EVOLUTION 4.2 Lamarkism and Neo-Lamarkism-Darwinism and Neo-Darwinism- Factors responsible for speciation. Variation – Adaptation & Selection.</p> <p>SERICULTURE 4.3 Commercial variety of mulberry, biology of silk worm – types of silk worm rearing operation – CHAWAKI and late age rearing techniques – physical and commercial characters of cocoon.</p>	12	CO4
5	<p>MODULE – V APICULTURE AND POULTRY REARING</p>	12	CO5

5.1 Apiculture – biology of honey bee, bee hives method of bee keeping – application for modern methods of apiculture – extraction of honey – economic importance of honey.		
5.2 Poultry rearing – Morphology of different breeds of chicken, brooding and rearing of chicks, by products of poultry – nutrition value of food.		

TEXT BOOKS:

1. Supriti Sarkar.2014. Introduction to Economic Zoology. New Central Book Agency.Kolkata.
2. Shukla GS.2014. Economic Zoology. Rastogi Publications.Uttar Pradesh.

REFERENCE BOOKS:

1. Ram Prabhu Jayasurya R.2013. Economic Zoology. Saras Publication.Nagercoil.
2. Ashok Kumar Rathoure.2015.Applied and Economic Zoology. Daya Publishing House.Daryaganj.

WEBSITES

[https://www.sciencedaily.com/terms/cell_\(biology\).htm](https://www.sciencedaily.com/terms/cell_(biology).htm)

<https://plato.stanford.edu/entries/cell-biology/>

<https://bscb.org/learning-resources/softcell-e-learning/what-is-a-cell/>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13209	ALLIED ZOOLOGY PRACTICAL	Allied Practical			4		2

Year	Semester	CIA	ESE	Exam Hours
First	First & Second	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to identify the specimens of animals and different animal association. The student can understand the procedures involved in the dissection and mounting of animals.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Compare the spotters of different species of animals	K1
CO2	Apply the methods for dissection and display of animals	K3
CO3	Apply the procedure for mounting on slides	K3
CO4	Discuss the various types of animal association	K1 & K2
CO5	Identify the different species of animals	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	2	2	3	3	3	3	3

CO2	3	3	2	3	3	2	2	2	2	3	2	2	3
CO3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO4	3	3	3	2	3	2	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

DISSECTION:

Cockroach: Digestive system, Nervous system

Prawn: Nervous system

MOUNTING:

1. Prawn appendages(Maxilla I & II, Mandible, Maxillepeds, Nonchelate leg and Chelate leg)
2. Mouth parts of Cockroach
3. Mouth parts of Mosquito
4. Earthworm body setae

SPOTTERS:

Entamoeba, Paramecium Sycon, Obelia geniculata, Obelia (medusa) Fasciola hepatica (Entire and T.S.), Taenia solium (Entire and T.S.) Scolex Proglottis. Leech (Entire and T.S.), Prawn entire, Fresh water mussel, Shark Entire (placoid scale), Frog entire, Calotis entire, Pigeon Entire (feathers) and Rabbit Entire.

Animal Association: Mutualism: Hermit crab and Sea anemone
 Commensalism: Shark and Sucker fish
 Parasitism: Ascaris.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	Class room Practical's	Record Submission	Attendance
Marks (out of 40)	20	15	5
Remember	5		
Understand	5		
Apply	5	15	
Analyze	5		
Evaluate			
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13206	PUBLIC HEALTH & HYGIENE	Part IV: NME -II	2				2

Year	Semester	CIA	ESE	Exam Hours
First	Second	40	60	03

LEARNING OBJECTIVES:

The course focuses on various communicable and non-communicable diseases, their source, and control measures. It also provides awareness on Health for a better society

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome.	Knowledge Level (According to Bloom's Taxonomy)
C01	Analyze the scope of public health and hygiene and their problems related to unhygienic conditions and malnutrition	K1
C02	Critique various pollution causing sources	K2
C03	Discuss various communicable diseases of man	K2
C04	Understand different types of non-communicable diseases	K2
C05	Apply Health education awareness for betterment of society	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO	PSO
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	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	1	1	2	1	2	2	2	1	3	3	2
CO2	3	3	2	2	3	2	3	1	2	1	3	3	3
CO3	3	3	3	1	3	2	3	2	2	2	3	3	3
CO4	3	3	2	1	2	2	3	2	2	2	3	3	3
CO5	3	3	1	2	3	3	3	2	2	1	3	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I 1.1 Scope of Public Health and Hygiene- Concepts of Health and Disease- History of Public Health in India. 1.2 Nutrition and Health: Classification of foods- Nutritional deficiencies – Vitamin deficiencies- Balanced diet- Nutritional requirements of special groups.	06	CO1
2	MODULE – II 2.1 Environment and Health: Water- sources, pollution, purification – water quality standards. 2.2 Air: Ventilation – Air pollution- Noise pollution – Radiation effects- Solid waste and excreta disposal – Sewage treatment.	06	CO2
3	MODULE – III 3.1 Communicable disease: Respiratory infections: Measles, Rubella, Mumps, Diphtheria, Intestinal infections;/ Poliomyelitis, Cholera, Typhoid, Amoebiasis. 3.2 Arthropod infections: Malaria, Filariasis, Dengue. 3.3 Zoonosis: Rabies, Plaque Japanese encephalitis. 3.4 Surface infection: Tetanus, Leprosy, STD and AIDS.	06	CO3
4	MODULE – IV 4.1 Non-Communicable Diseases: Coronary Heart Diseases- Hypertension- Diabetes- Obesity- Blindness- Stroke. 4.2 Occupational Health Hazards: Physical, Chemical, Mechanical, Biological and Psychological. 4.3 Mental Health: Causes of Mental illness- Health- Alcoholism and Drug dependence.	06	CO4
5	MODULE – V 5.1 Health Education: Health Planning in India- Health Programmes in India – WHO- Non- Governmental Voluntary Health Organizations. 5.2 First Aid and Nursing: Methods- Dressing – Care- Duties- Preparations.	06	CO5

TEXT BOOKS:

1. Park and Park, 1995. Text Book of preventive and Social Medicine. M/S. Banarsidas Bhanot Publishers, Jabalpur.
2. Verma S. 1998. Medical Zoology, Rastogi Publications, New Delhi.

REFERENCE BOOKS:

1. Sudhir R. Wagh, Public Health and Hygiene, Success publications, U.P
2. Contemporary Public Health: Principles, Practice, and Policy. Contributors: James W. Holsinger Jr. - Editor. Publisher: University Press of Kentucky. Place of publication: Lexington, KY. Publication year: 2013

WEBSITES:

<http://aiihph.gov.in/>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1808522/>
https://en.wikipedia.org/wiki/Public_health

ASSESSMENT PATTERN**CIE- Continuous Internal Evaluation (40 Marks)**

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13309	BRYOPHYTES AND PTERIDOPHYTES	Core Paper : IV	6				5

Year	Semester	CIA	ESE	Exam Hours
Second	Third	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to understand structural variation in bryophytes and Pteridophytes. The student will be able to study the classification of Bryophytes and Pteridophytes and the significance of Bryophytes as pioneer plants on land. It provides knowledge on structure and reproduction of certain selected Bryophytes and Pteridophytes forms. The last part of the course will enable the student to know about the steles, sporangial organization and economic importance of Pteridophytes.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Illustrate about the nature of non vascular plants	K1
CO2	List out examples of various non vascular forms	K1
CO3	Understand about first land plants and classify them	K2
CO4	Point out living forms of vascular plants	K3
CO5	Understand the origin and importance of vascular plants	K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	2	3	3	2	2	2	3	3	2	2	2

CO2	3	2	3	3	3	2	3	2	3	3	2	2	2
CO3	3	3	3	3	3	3	2	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	1	3	3	3	2	2	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I BRYOPHYTES 1.1 General Characters of Bryophytes 1.2 Classification (Watson), 1.3 Life cycle, origin and evolution of Bryophytes. 1.4 Spore dispersal mechanism in Bryophytes.	20	CO1
2	MODULE – II 2.1 General Characters of Hepaticopsida, Anthocerotopsida and Bryopsida 2.2 Detailed study of following genera (No developmental studies)- <i>Marchantia</i> 2.3 <i>Anthoceros</i> 2.4 <i>Polytrichum</i>	20	CO2
3	MODULE – III PTERIDOPHYTES: 3.1 General Characters of Pteridophytes 3.2 Classification (Reimer 1954) 3.3 Apogamy and Apospory, 3.4 Homospory and Heterospory 3.5 Origin and evolution of Pteridophytes	20	CO3
4	MODULE – IV 4.1 Detail study of the following genera (No developmental studies) - <i>Lycopodium</i> 4.2 <i>Selaginella</i> 4.3 <i>Equisetum</i> 4.4 <i>Adiantum</i> 4.5 <i>Marsilea</i>	20	CO4
5	MODULE – V 5.1 Stellar Evolution. 5.2 Sporangial organization and evolution. 5.3 Economic importance of Pteridophytes	10	CO5

TEXT BOOKS:

1. Vashishta B.R *etal.*2010.Botany for Degree Students – Bryophyta. S.Chand Publications, New Delhi.
2. Singh, Pande and Jain. 2017. Text book of Botany- Rastogi publications 5th edition. New Delhi
3. Pandey B.R. 1977 – A text book of Botany, Pteridophytes and Gymnosperms, K.Nath and Merrut.
4. A.V.S.S. Sambamurty. 2005.A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany.

REFERENCE BOOKS:

1. Eames A., 1963- Morphology of lower vascular plants. McGraw Hill, New Delhi.
2. Tuba, Z., N.G., Sleck and L.R. Stark. 2011. Bryophyte, Cambridge University Press, UK.

WEBSITES:

<https://www.anbg.gov.au/bryophyte/what-is-bryophyte.html>
<http://www.theplantlist.org/browse/P/>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20

Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13410	GYMNOSPERMS, PALAEOBOTANY & EVOLUTION	Core Paper : V	6				5

Year	Semester	CIA	ESE	Exam Hours
Second	Fourth	40	60	03

LEARNING OBJECTIVES:

On taking this course, the Student will be able to understand morphological, anatomical and reproductive features of first seed plants. The student will also be able to get a glimpse of fossil plants, their time period, methodologies of fossilization and evolution of various life forms.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Discuss about first naked seed bearing plants	K1
C02	Evaluate external and internal features of naked seed bearing plants	K2
C03	Criticize the extinct plants and their origin	K2
C04	Understand extinct plant forms	K2
C05	Analyze the various theories behind origin of life	K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED - 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I GYMNOSPERMS 1.1 General characters and Classification of Gymnosperms (Sporne, 1954) 1.2 Wood structure 1.3 Economic importance of Gymnosperms	20	CO1
2	MODULE – II 2.1 Morphology, Anatomy and reproduction of the following genera (No developmental studies) - <i>Cycas</i> 2.2 <i>Pinus</i> 2.3 <i>Gnetum</i>	20	CO2
3	MODULE – III PALAEOBOTANY 3.1 Geological Time Scale 3.2 Fossilization methods – Fossil types, Impression, Casts, mold and Coal ball. 3.3 Radio carbon dating 3.4 Contribution of Birbal Sahni	20	CO3
4	MODULE – IV 4.1 Study of the following fossil genera - <i>Lepidodendron</i> 4.2 <i>Lepidocarpon</i> 4.3 <i>Calamites</i>	20	CO4
5	MODULE – V EVOLUTION 5.1 Origin of Life, 5.2 Theories of Evolution (Darwin, Larmarck and De Vries), 5.3 Modern synthetic theory. 5.4 Phylogeny of seed plants.	10	CO5

TEXT BOOKS:

1. Sambamurty A. V. S. S, 2005, A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany, I K International Publishing House Pvt. Ltd.
2. Vashista, 2009, Gymnosperms. S.Chand & Co. New Delhi.

REFERENCE BOOKS:

1. Sporne K.R. 1954. Morphology of Gymnosperms, Hutchinson University Library.
2. Stewart, 2005, Paleobotany and the Evolution of Plants, Cambridge University Press.

WEBSITES:

<https://www.thoughtco.com/what-are-gymnosperms-4164250>

<http://www.theplantlist.org/browse/G/>

<https://www.britannica.com/plant/gymnosperm>

ASSESSMENT PATTERN**CIE- Continuous Internal Evaluation (40 Marks)**

Bloom's Category	CIA	Third Component (10 Marks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
16-19/13412	PRACTICAL – II (Bryophytes, Pteridophytes, Gymnosperms, Paleobotany And Evolution)	Core Paper : VI			8		4

Year	Semester	CIA	ESE	Exam Hours
Second	Third & Fourth	40	60	03

LEARNING OBJECTIVES:

At the end of the Course, the student will be able to prepare and identify microslides of Bryophytes, Pteridophytes and Gymnosperms. The student will be able to identify fossil specimens and evolutionary scientists.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Dissect and explain vegetative parts of Vascular and Non vascular plants	K3
C02	Dissect and explain the reproductive parts of Vascular and Non vascular plants	K3
C03	Examine the permanent micro slides of Vascular and Non vascular plants	K2
C04	Analyze the fossil forms and the reasons for fossilization	K2
C05	Identify the evolutionary Biologists and their related theory	K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	2	2	2	3	3	3	2	3	3	3	3	3
CO4	2	3	3	2	3	3	3	3	3	2	3	3	3
CO5	3	3	2	2	3	3	3	3	3	2	2	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

BRYOPHYTES, PTERIDOPHYTES

1. Micropreparation of types prescribed in the syllabus
2. Identifying the micro slides relevant to the syllabus.

GYMNOSPERMS, PALAEOBOTANY & EVOLUTION

1. Micropreparation of types prescribed in the syllabus
2. Identifying the microslides relevant to the syllabus.
3. Identifying the Fossil slides relevant to the syllabus
4. Photograph of evolutionary scientists

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	Class room Practical's	Record Submission	Attendance
Marks (out of 40)	20	15	5
Remember	5		
Understand	5		
Apply	5	15	
Analyze	5		
Evaluate			
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
09-18/13412/35433	ENVIRONMENTAL STUDIES	PART IV: EVS	4				2

Year	Semester	CIA	ESE	Exam Hours
Second	Third & Fourth	40	60	03

LEARNING OBJECTIVES:

The student will be able to understand various natural resources and environmental aspects along with factors affecting it and volunteer themselves for social activities. They will be able to know the conservation strategies of natural resources and how to prevent the different types of pollution and create awareness on AIDS.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Discuss about natural resources and apply the conservation of natural resources.	K1 & K3
CO2	Discuss the structure and functions of an ecosystem and natural curiosity and creativity for the immediate surroundings	K1
CO3	Summarize the sources, effects and control measures of various types of Pollutants and awareness of conservation of biodiversity	K1, K2 & K3
CO4	Apply the methods for sewage treatment and rain water harvesting	K2 & K3

CO5	Acquire the awareness on communicable disease (AIDS) and awareness on natality	K3
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K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	2	2	3	3	3	3	3	2	2	3	2
CO2	3	3	3	3	3	2	3	3	3	3	3	3	3
CO3	3	2	3	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	2	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I 1.1 The Multidisciplinary nature of environmental studies. 1.2 Definition, Scope and Importance. Need for public awareness.	15	CO1&CO2
2	MODULE – II Natural Resources Renewable and non-renewable resources Natural resources and associated problems a) FOREST RESOURCES ; Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. b) WATER RESOURCES : Use and over-utilization of surface and ground water, floods, drought,. Conflicts over water, dams benefits and problems. c) MINERAL RESOURCES : Use and exploitation, environmental effects of extracting and using mineral resources, Case studies. d) FOOD RESOURCES : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging salinity, case studies. e) ENERGY RESOURCES : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies. f) LAND RESOURCES : Land as a resource. Land degradation, man induced landslides, soil erosion and desertification.	15	CO1&CO2

	Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.		
3	<p>MODULE – III</p> <p>3.1 Ecosystems, Concept of ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.</p> <p>3.2 Introduction, types characteristic features, structure and function of the following ecosystems: Forest ecosystem Grassland ecosystem Desert ecosystem Aquatic ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)</p>	15	CO2&CO3
4	<p>MODULE – IV</p> <p>4.1 Biodiversity and its conservation.</p> <p>4.2 Introduction : Definition: genetic, species and ecosystem diversity, Biogeographical classification of India.</p> <p>4.3 Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values.</p> <p>4.4 Biodiversity at global, national and local levels, India as a mega-diversity nation</p> <p>4.5 Hotspots of biodiversity, Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts.</p> <p>4.6 Endangered and endemic species of India. Conservation of biodiversity: In situ and Ex situ conservation of biodiversity.</p>	15	CO3
5	<p>MODULE – V</p> <p>5.1 Environmental Pollution, Definition Causes, effects and control measures of: Air pollution, Water Pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.</p> <p>5.2 Solid waste management: causes, effects and control measures of urban and industrial wastes.</p> <p>5.3 Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquakes, cyclones and landslides.</p>	15	CO4
6.	<p>MODULE-VI</p> <p>6.1 Social Issues and the Environment, From unsustainable to sustainable development - Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns, Case studies.</p> <p>6.2 Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation.</p> <p>6.3 Consumerism and waste products, Environment protection Act, Air (Prevention and control of pollution) Act, Water (Prevention and control of</p>	15	CO4

	pollution) Act, Wildlife protection Act. Forest Conservation Act, Issues involved in enforcement of environmental legislation,Public awareness.		
7.	MODULE –VII 7.1 Human Population and the Environment, Population growth, variation among nations, Population explosion – Family Welfare programme, Environment and human health, Human Rights. 7.2 Value Education, HIV/ AIDS, Women and Child welfare 7.3 Role of information Technology in Environment and human health, Case studies.	15	CO5
8	MODULE -VIII FIELD WORK 8.1 Visit to a local area to document environmental assets – river / forest/ grassland / hill/ mountain. 8.2 Visit to a local polluted site – Urban/Rural/ Industrial/ Agricultural. Study of common plants, insects, birds. 8.3 Study of simple ecosystems – pond ,river, hill slopes, etc.	15	

TEXT BOOKS:

1. Erach Bharucha, 2013. Textbook of Environmental Studies for Undergraduate Courses, Orient BlackSwan.
2. Sarita Kumar, 2018. Fundamentals of Environmental Studies, Sultan Chand & Sons Pvt. Ltd.

REFERENCE BOOKS:

1. R. Rajagopalan, 2015. Environmental Studies, Oxford University Press.
2. Benny Joseph, 2017. Environmental Studies, McGraw Hill Education.

WEBSITES:

<http://www.yourarticlelibrary.com/environment/environmental-studies-meaning-objectives-scope-and-importance-of-environmental-studies/12295>

https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

<https://study.com/academy/lesson/what-is-environmental-studies-definition-topics.html>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	

Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613515/1713513	PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY	Core Paper : VII	5				5

Year	Semester	CIA	ESE	Exam Hours
Third	Fifth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to understand various Angiosperms plant habits, their vegetative and reproductive structural features. The student understands the systems of classification of angiosperms, principles involved in naming and identification of angiosperm plants. They will be able to identify members of major angiosperm families by observing key characters and economic importance of the families studied. The last part of the course will enable the students to know the economically important plant products and their utilization.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Understand the Plant Morphology terminologies	K1,k2
CO2	Understand the Principles of classification and nomenclature and Collect, identify and preserve plants	K2
CO3	Identify members of the families in Polypetalae and Gamopetalae by observing diagnostic features and economic importance	K2,K3
CO4	Identify members of the families in Monochlamydae and Monocots by observing diagnostic features and economic importance	K2,K3
CO5	Illustrate the Cultivation methods and uses of some economically important plants	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	2	2	3	3	3	2	3	3	3	2	3	3
CO2	3	3	3	2	3	2	2	2	3	2	2	2	3
CO3	3	2	3	3	3	3	2	2	3	3	2	3	3
CO4	3	2	3	3	3	3	2	2	3	3	2	3	3
CO5	3	3	2	3	3	3	2	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED - 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I PLANT MORPHOLOGY: 1.1 Morphology – root system – modifications. 1.2 Shoot system – modifications (Aerial, subaerial and underground). 1.3 Leaf simple and compound – Phyllotaxy, modifications, (phyllode, pitcher) tendrils, stipules.	15	CO1

	1.4 Inflorescences – definition and types – racemose, cymose, and special types. 1.5 Flowers: parts of a flower and their detail description; aestivation, placentation. 1.6 Fruit – Classification and types.		
2	MODULE – II TAXONOMY: 2.1 History of Angiosperm 2.2 Classification - Systems of plant classification – Artificial (Linnaeus), 2.3 Natural (Bentham and Hooker) 2.4 Modern and Phylogenic (Engler & Prantl) – Merits and Demerits of each system of classification 2.5 Overview of APG classification. 2.6 Hebraium techniques. 2.7 Botanical Survey of India, 2.8 Botanical Nomenclature – Rules, Typification and Author citation.	15	CO2
3	MODULE – III 3.1 Study of the following families based on the Natural System of Classification and their economic importance 3.2 Polypetalae : Annonaceae, Capparidaceae, Rutaceae, Caesalpiniaceae and Cucurbitaceae 3.3 Gamopetale: Asclepiadaceae, Apocynaceae, Solanaceae and Acanthaceae	15	CO3
4	MODULE – IV 4.1 Study of the following families based on the Natural System of Classification and their economic importance: Monochlamydae: Euphorbiaceae and Amaranthaceae 4.2 Monocot: Orchidaceae, Liliaceae and Poaceae	15	CO4
5	MODULE – V ECONOMIC BOTANY 5.1 Source, cultivation methods (brief) and extraction/processing of the economically important products of the following: 5.2 Cereal (Rice) 5.3 Sugar (Sugarcane) 5.4 Fibre (Cotton) 5.5 Beverages (Coffee) 5.6 Oil (Ground nut & Castor)	15	CO5

TEXT BOOKS:

1. Ventakeswaralu, V. 1982 . External Morphology of Angiosperms, S. Chand & Co .Ltd., New Delhi
2. Singh,V. and K. Jain. 1991. Taxonomy of Angiosperms, Rastogi Publications, Meerut.
3. Vasishta, P.C. 1992. Taxonomy of Angiosperms, R. Chand and Co.Ltd., New Delhi
4. Pandey, B.P. 1992. Economic Botany. S. Chand & Co .Ltd., New Delhi

5. Narayanaswami, R.V., K.N.Rao and A. Raman 2000. Outlines of Botany, S.Viswanathan Printers and Publishers, Chennai.
6. Kochar, S.L. 2010. Economic Botany in the tropical (4th Ed.) . MacMillian Publishers, India Ltd., New Delhi.
7. Sharma, O.P. 2011. Plant Taxonomy, Tata McGraw Hill Education, New Delhi.
8. Pandey, B.P. 2013. Taxonomy of Angiosperms. S. Chand & Co .Ltd., New Delhi
9. Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. The McMillian Co., New York.
10. Heywood, V.K., 1967 Plant Taxonomy. Edward Arnold Pub. Ltd. London.

REFERENCE BOOKS:

1. Davis, P.H. and Heywood, V.H. 1967. Principles of Angiosperm Taxonomy. Oliver and Boyd, Edinburgh.
2. Hill, A.F. 1982. Economic Botany, McGraw Hill, New York.
3. Albert, F. Hill, P.P. Sharma, 1996. Hill's Economic Botany, Tata McGraw Hill. New Delhi.
4. Simpson, B.B and Ogorzaly, M.C.2001. Economic Botany: Plants in our World, (3rd Ed), McGraw-Hill Higher Education. New York.
5. Simpson, M.G. 2010. Plant Systematics, Second Edition. Academic Press.

WEBSITES:

<http://www.askiitians.com/revision-notes/biology/morphology-of-flowering-plants/>

<http://www.biologydiscussion.com/plant-taxonomy/plant-taxonomy-history-classification-and-plant-kingdom/41749>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613516/1713514	PLANT ANATOMY AND EMBRYOLOGY	Core Paper : VIII	4				4

Year	Semester	CIA	ESE	Exam Hours
Third	Fifth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to understand various tissues and internal structures of root stem and leaves. They can be able to understand the secondary and anomalous growth of both monocot and dicot plants. This course also enables the students to understand the embryology of angiospermic plants.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Discuss the Basic organization of various types of tissues	K1,K2
CO2	Understand the anatomy of Primary & Secondary growths in Stem & Roots	K2
CO3	Explain the Knowledge on Anomalous Secondary growth in Dicot & Monocot Plants	K1
CO4	Comprehend the structure and development of male and female gametophytes in plants	K2
CO5	Compare the structure and development of dicot and monocot embryos	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	2	2	2	3	3	2	2	3	3	3	3	2
CO2	3	3	2	3	2	2	2	3	3	3	3	2	2
CO3	3	3	2	3	2	2	2	3	3	3	3	2	2
CO4	3	3	3	2	3	2	2	3	3	3	2	2	2
CO5	3	3	2	2	3	2	2	3	3	3	2	2	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I PLANT ANATOMY: 1.1 Cell wall – structure and functions. 1.2 Tissues – Definition, Types – Simple permanent – Parenchyma, collenchyma, sclerenchyma. 1.3 Complex permanent tissues – Xylem and Phloem. 1.4 Meristems- Classifications. Vegetative shoot apex and root apex. 1.5 Theories of shoot apex and root apex organization.	12	CO1
2	MODULE – II 2.2 Epidermal tissue system – Important functions. 2.3 Stomata – Types of stomata, 2.4 Trichomes - glandular and non- glandular trichomes	12	CO2

	<p>2.5 Some special epidermal cells – silica, cork, crystal- containing and bulliform cells.</p> <p>2.6 Vascular tissue system & types of vascular bundles.</p> <p>2.7 Stem – primary anatomical structure of dicot and monocot stem.</p> <p>2.8 Secondary growth in dicot stem.</p>		
3	<p>MODULE – III</p> <p>3.1 Anomalous secondary growth in <i>Nyctanthes</i>, <i>Boerhaavia</i> and <i>Dracena</i>.</p> <p>3.2 Root- Primary anatomical structure of dicot and monocot roots.</p> <p>3.3 Secondary growth in dicot roots.</p> <p>3.4 Leaf- Anatomy of Dicot and Monocot</p> <p>3.5 Nodal anatomy and Krantz anatomy.</p>	12	CO3
4	<p>MODULE – IV</p> <p>EMBRYOLOGY:</p> <p>4.1 Microsporangium / Microsporogenesis</p> <p>4.2 Development of male gametophyte.</p> <p>4.3 Megasporangium / Megasporogenesis,</p> <p>4.4 Development of female gametophyte</p> <p>4.5 Different types of Ovule</p> <p>4.6 Monosporic, Polygonum and Oenothera</p> <p>4.7 Bisporic – Allium</p> <p>4.8 Tetrasporic – Pepromia</p>	12	CO4
5	<p>MODULE – V</p> <p>5.1 Development of dicot embryo – Capsella,</p> <p>5.2 Endosperm – definition and types. free cellular , cellular, helobial.</p> <p>5.3 Endosperm haustoria.</p> <p>5.4 Development of Monocot embryo – Najas.</p> <p>5.5 Different types of polyembryony.</p> <p>5.6 Parthenogenesis and Parthenocarpy, Double fertilization.</p>	12	CO5

TEXT BOOKS:

1. B.P. Pandey, 2001, Plant Anatomy, S. Chand & Company Ltd, New Delhi.
2. Bhojwani and Bhatnagar, 1994, Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1. Fahn. A ,1990, Plant Anatomy (4th Ed.) Butterworth-Heinemann Ltd.
2. Swamy. B.G.L and Krishnamoorthy. K. V, 1990, From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.
3. Esau. K, 2006, Anatomy of seed plants (2nd Ed.) – John Willey.

WEBSITES:

<https://www.encyclopedia.com/social-sciences/applied-and-social-sciences-magazines/plant-anatomy>

<http://www.biologydiscussion.com/embryology/top-16-stages-of-embryology-in-plants-with-diagram/34153>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613517/1713515	CELL BIOLOGY AND MOLECULAR BIOLOGY	Core Paper : IX	5				4

Year	Semester	CIA	ESE	Exam Hours
Third	Fifth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will list the distinctive features and importance of cell organelles. The student will also be able to distinguish between the structure of DNA and RNA.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Compare two different cell types and its process	K2
C02	Outline the structure and functions of various cell organelles	K1
C03	Apply concepts of genetic engineering	K3
C04	Explain in detail about nucleic acids	K2
C05	Discuss applications of molecular tools and diagnostics	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
C01	3	3	2	3	3	3	2	3	3	3	3	3	3
C02	3	2	2	3	3	3	3	3	3	2	2	3	3
C03	3	3	1	3	3	3	3	3	3	3	3	3	3
C04	3	3	2	3	3	3	3	2	3	3	3	3	3
C05	3	3	3	3	3	3	3	3	3	3	2	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I CELL BIOLOGY: 1.1 Prokaryotes and Eukaryotes. 1.2 Plasma membrane - Molecular structure, Chemical nature, functions. 1.3 Cell cycle – Cell division – Mitosis, Meiosis 1.4 Cytokinesis	15	C01

2	MODULE – II 2.1 Occurrence, Ultra Structure, functions and origin of Cell organelles - Endoplasmic reticulum, 2.2 Golgi bodies, 2.3 Microbodies- Lysosomes, Peroxisomes, 2.4 Mitochondria 2.5 Chloroplast. 2.6 Nucleus: General Structure – Nuclear envelope, Ultra Structure 2.7 Chromosome Morphology- Fine structure. 2.8 Giant chromosomes- polytene and lampbrush. 2.9 Euchromatin and Heterochromatin	15	CO2
3	MODULE – III 3.1 Introduction to Genetic Engineering; Restriction endonucleases. 3.2 Cloning vectors – Plasmids, cosmids, Phagemids 3.3 cDNA libraries 3.4 Hybridisation – Southern, Northern and Western Blotting techniques.	15	CO3
4	MODULE – IV MOLECULAR BIOLOGY: 4.1 Nucleic acids – Structure and chemistry of nucleosides and nucleotides. 4.2 Types of DNA molecular structure and replication of DNA. 4.3 Molecular structure of RNA (mRNA, rRNA and tRNA).	15	CO4
5	MODULE – V 5.1 Genetic code 5.2 Ribosomes- occurrence, structure and types of Ribosomes, chemical composition and biogenesis. 5.3 Protein synthesis in prokaryotes 5.4 Gene regulation in prokaryotes – Lac operon. 5.5 Restriction enzymes. 5.6 Principle and applications of PCR, RFLP.	15	CO5

TEXT BOOKS:

1. Verma. P.S and Agarwal. V. K, 2006, Cell Biology, S Chand Publishing, New Delhi.
2. David Freifelder, 1997. Molecular Biology. Narosa Publications. New Delhi.

REFERENCE BOOKS

1. Benjamin Lewin 2007. Genes- IX , Jones and Bartlett Publishers.
2. Harvey Lodish, Arnold Berk ,Chris A. Kaiser and Monty Krieger, 2007, Molecular Cell Biology, W. H. Freeman, USA.

WEBSITES:

- <https://www.microscopemaster.com/cell-biology.html>
<https://plato.stanford.edu/entries/molecular-biology/>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Marks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613518/1713516	GENETICS, PLANT BREEDING AND BIostatISTICS	Core Paper : X	5				4

Year	Semester	CIA	ESE	Exam Hours
Third	Fifth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to understand the mendelian and non-mendelian genetics. The student will be able to understand the sex determination in plants and abnormalities arising due to genetic disorders. The student will be able to understand the breeding techniques and will be able to calculate bio statistical problems.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Identify father of genetics and the role of genes in biotic community	K2
CO2	Understand the concepts of heredity, their role in determining gender in plants and factors that causes abnormality of genes.	K2
CO3	Remember the theories put forward in a biome	K1
CO4	Evaluate various practices for crop improvement	K2
CO5	Apply the statistical approach to various problems	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	2	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3	3	3	3
CO3	3	2	2	2	3	3	2	2	3	2	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
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1	<p>MODULE – I GENETICS: 1.1 Mendelian genetics – Monohybrid, Dihybrid, Reciprocal cross, Back and test cross. 1.2 Incomplete dominance – <i>Mirabilis jalapa</i> - Allelic and non-allelic gene interactions. 1.3 Polygenic inheritance 1.4 Pseudo alleles and lethal alleles. 1.5 Extranuclear inheritance – cytoplasmic and maternal effects. 1.6 Chromosome theory of linkage, crossing over, recombination and mapping of genes on chromosomes.</p>	15	CO1
2	<p>MODULE – II 2.1 Sex determination in plants 2.2 Polyploidy- origin, types and significance. 2.3 Genetics of <i>Neurospora</i>. 2.4 Sex linked inheritance. 2.5 Mutation – Mutagens 2.6 Variations in chromosome structure and number Euploidy and Aneuploidy 2.7 Biochemical mutants in <i>Neurospora</i>. 2.8 Fine structure of genes. 2.9 Evidence for DNA as genetic material.</p>	15	CO2
3	<p>MODULE – III 3.1 Population genetics: Hardy – Weinberg law 3.2 Factors affecting equilibrium – Genetic drift, Inbreeding, balanced polymorphism and Founder effects.</p>	15	CO3
4	<p>MODULE – IV PLANT BREEDING: 4.1 Principles involved in plant breeding and its importance with reference to wheat, rice, sugarcane, maize and cotton. 4.2 Methods of crop improvement: Selection (pure line, mass and clonal), 4.3 Hybridization, introduction and acclimatization. 4.4 Heterosis - causes and effects. 4.5 Polyploidy in plant breeding. 4.6 Breeding for disease resistance.</p>	15	CO4
5	<p>MODULE – V BIOSTATISTICS: 5.1 Measures of central tendency – mean, median and mode and measures of dispersion. 5.2 Standard deviation and mean deviation. 5.3 Testing of hypothesis. Simple definition of Null hypothesis, t- test, chi-square test.</p>	15	CO5

TEXT BOOKS:

1. Verma PS and Agarwal VK., 2010. Genetics, S. Chand Publications, New Delhi.
2. Dipak Kumar Kar and Soma Halder. 2010. Plant Breeding, Biometry, Biotechnology. New Central Book Agency, Kolkata.
3. Gurumani N., 2011. An Introduction to Biostatistics. MJP Publishers, Chennai.

REFERENCE BOOKS:

1. Klug, Cummings and Spencer. 2016. Concepts of Genetics, Pearson Education India.
2. Allard.R.W.(1960) – Principles of Plant breeding, John Wiley & sons, INC., New York.

WEBSITES

- <https://www.britannica.com/science/genetics>
<https://www.plantbreeding.org/content/what-is-plant-breeding>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
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1613519/1713517	HORTICULTURE AND MUSHROOM CULTIVATION	Core Elective : I	5				5
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Year	Semester	CIA	ESE	Exam Hours
Third	Fifth	40	60	03

LEARNING OBJECTIVES:

At the end of the Course, the student will be able to understand various aspects of Horticulture with preference to their economic importance along with practices of mushroom cultivation and its scope.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Discuss the history and various management practices in Horticulture	K2
CO2	Demonstrate the about Hydroponic culture and organic farming	K2, K3
CO3	Analyze the different crop protection measures and Plant propagation techniques	K2
CO4	Comprehend the harvest and storing technology	K1
CO5	Explain the Prospects and Scope of Mushroom cultivation	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	2	3	2	3	3	3	3	3	3	2	3	3
CO2	3	3	2	3	2	2	2	3	3	2	2	2	3
CO3	3	2	2	3	3	3	2	2	2	2	3	2	3
CO4	3	2	2	3	2	2	3	2	2	2	2	3	3
CO5	3	3	2	2	3	2	2	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
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1	MODULE – I HORTICULTURE 1.1 Brief history of Horticulture 1.2 Horticultural crops, economic importance. 1.3 Essential of Nursery management – Soil Management - Garden soil 1.4 Physiochemical properties of soil, organic matter, compost, cultural practices. 1.5 Water management: Water quality, irrigation and mulching. 1.6 Nursery structure : protected cultivation (greenhouses), environmental controls.	15	CO1
2	MODULE – II 2.1 Hydroponic culture – types of container. 2.2 Use of manures and fertilizers in Horticultural crop production. 2.3 Organic farming. 2.4 Environmental factors influencing vegetable and fruit production.	15	CO2
3	MODULE – III 3.1 Horticultural crops protection; physical control – pruning. 3.2 Chemical control – Pesticides and Fungicides. 3.3 Plant propagation – cutting, layering and grafting. 3.4 Indoor gardening. 3.5 Floriculture, ornamental gardening and landscaping.	15	CO3
4	MODULE – IV 4.1 Technology of horticultural crops – market preparation; harvesting and handling, packaging and transport, storage; chemical treatment. 4.2 Food processing – Freezing, bottling and canning, drying and chemical preservation.	15	CO4
5	MODULE – V MUSHROOM CULTIVATION 5.1 Prospects and scope of Mushroom cultivation – Paddy straw – Oyster mushroom. 5.2 Life cycle of <i>Pleurotus</i> sp. Nutritional value and control of pest and pathogens. 5.3 Post harvesting techniques and storage methods of mushroom. 5.4 Marketing.	15	CO5

TEXT BOOKS:

1. Handbook of Mushroom cultivation, 1999, TNAU Publication. Coimbatore.
2. Chadha. K .L, 2003. Handbook of Horticulture, Indian Council Of Agricultural Research, New Delhi.

REFERENCE BOOKS:

1. Randhawa, G.S. and Amitabha Mukhopadhyay, 1986. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.
2. Suman, 2005. Mushroom Cultivation Processing and Uses M/s.IBD Publishers and Distributors, New Delhi.

WEBSITES:

http://agritech.tnau.ac.in/horticulture/horti_index.html

[http://nhb.gov.in/button_mushroom_report.aspx?enc=3ZOO8K5CzcdC/Yq6HcdIxMDNqXAfC
KV7Vr4L5zsSZ1A=](http://nhb.gov.in/button_mushroom_report.aspx?enc=3ZOO8K5CzcdC/Yq6HcdIxMDNqXAfC
KV7Vr4L5zsSZ1A=)

<https://extension.psu.edu/six-steps-to-mushroom-farming>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613621/1713618	PLANT ECOLOGY AND PHYTOGEOGRAPHY	Core Paper : XI	4				4

Year	Semester	CIA	ESE	Exam Hours
Third	Sixth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to understand the fundamentals of ecology and learn various components of ecosystem and their degradation. The student will be able to learn the biodiversity and its components and also their conservation. The last part of the course will enable the students to know about the principles of plant geography and various forest types.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Compare biotic and abiotic factors influence on vegetation, and gather knowledge on various habitats	K1
C02	Explain the components of ecosystem	K2
C03	Evaluate hierarchy of biotic community and their importance in balancing the ecosystem	K3
C04	Identify the procedures for better conservation	K3
C05	Understand distribution of plants and various types of vegetation	K1,K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
C01	3	3	3	3	3	3	2	2	3	2	3	3	3
C02	3	3	2	2	3	3	2	3	3	2	3	2	3
C03	3	3	3	3	3	3	3	3	3	3	3	3	3
C04	3	3	3	3	3	3	3	3	3	3	3	3	3
C05	3	3	3	3	3	3	2	3	3	2	3	2	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	<p>MODULE – I PLANT ECOLOGY</p> <p>1.1 Importance of study of ecology- Biotic and abiotic factors and their influence on vegetation- a brief account of light, temperature, wind, fire, plants, animals.</p> <p>1.2 Plant succession- Primary and Secondary – Hydrosere, Xerosere. Morphological and anatomical adaptations of Hydrophytes, Xerophytes, Halophytes and Epiphytes.</p>	12	CO1
2	<p>MODULE – II</p> <p>2.1. Ecosystem- concept and components, Food chain, Food web and Energy flow in ecosystem.</p> <p>2.2 Types of ecosystem – Aquatic and terrestrial ecosystem.</p> <p>2.3 Ecological pyramids.</p> <p>2.4 Ecosystem degradation – Deforestation, Overgrazing, Agriculture, Mining and Urbanisation.</p>	12	CO2
3	<p>MODULE – III</p> <p>3.1 Biodiversity Introduction - Levels of Biodiversity – Genetic, Species, Community and Ecosystem diversity.</p> <p>3.2 Uses of Biodiversity.</p> <p>3.3 Threats to Biodiversity – Extinction of species a. Natural b. Mass c. Anthropogenic.</p> <p>3.4 Endemism, Hotspots and Megadiversity.</p>	12	CO3
4	<p>MODULE – IV</p> <p>4.1 Natural resources and its conservation: <i>In situ</i> approach, biosphere reserves, reserve forests, parks and sanctuaries.</p> <p>4.2 <i>Ex situ</i> approach Garden and cryopreservation.</p> <p>4.3 International organizations in conservation – IUCN, IBPGR, WWF, UNEP and FAO.</p> <p>4.4 Endangered flora – their identification and documentation - Red Data Book.</p>	12	CO4
5	<p>MODULE – V PHYTOGEOGRAPHY</p> <p>5.1 Principles of Plant geography.</p> <p>5.2 Distribution – Wides, Endemics, Discontinuous species.</p> <p>5.3 Theories of Discontinuous distribution- Theory of Land Bridge, Theory of Continental drift.</p> <p>5.4 Factors affecting distribution of species- geological history and Distribution, Migration, Ecological amplitude.</p> <p>5.5 Vegetation types of India – Deciduous Forest, Tropical Dry Evergreen Forest, Mangrove Vegetation and Tropical Evergreen Forest with reference to Tamil Nadu.</p>	12	CO5

TEXT BOOKS:

1. Shukla R.S and Chandel P.S. 1990 Plant ecology S.Chand Publications, New Delhi.
2. Krishnamurthy K.V. 2003 An advanced text books on Biodiversity – Principle and practice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Michael P.N. 2015. Ecology.CBS Publishers. New Delhi.

REFERENCE BOOKS:

1. Melchias G. 2001 – Biodiversity and Conservation. Science Publishers Inc. USA.
2. Chapman J.L.and Reiss M.J., 2005. Ecology : Principles And Applications (2nd Ed), Cambridge University Press.

WEBSITES

<https://www.intechopen.com/books/plant-ecology-traditional-approaches-to-recent-trends/introductory-chapter-plant-ecology>
<http://www.biologydiscussion.com/ecology/phytogeography-climate-vegetation-and-botanical-zones-of-india/6925>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613622/1713619	PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY	Core Paper : XII	5				5

Year	Semester	CIA	ESE	Exam Hours
Third	Sixth	40	60	03

LEARNING OBJECTIVES:

The student will be able to understand water relations and their mechanisms. The student will be able to understand concept of photosynthesis, respiration, hormones required for growth and development of plants and their chemical composition with the role of enzymes.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Evaluate Physiological process and its significance	K1,K2
CO2	Understand the entire process of Photosynthesis	K2
CO3	Compile respiration process and importance of nitrogen in plant development	K3
CO4	Identify reasons for plant growth and development	K1,K2
CO5	Explain concepts of plant biochemistry	K1,K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	2	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	<p>MODULE – I PLANT PHYSIOLOGY</p> <p>1.1 Water relations- diffusion, permeability, osmosis, water potential and its components.</p> <p>1.2 Absorption of water – apoplast and symplast.</p> <p>1.3 Mechanism – passive and active.</p> <p>1.4 Transpiration – types and significance. Stomatal mechanisms.</p>	15	CO1
2	<p>MODULE – II</p> <p>2.1. Photosynthesis, radiant energy, structure of photosynthetic pigment system, red drop phenomenon Emersons Enhancement effect.</p> <p>2.2 Light Harvesting systems (LHS) – Z scheme – cyclic and Non cyclic photophosphorylation – mechanism – Photosynthetic carbon reduction pathways in C3 and C4 plants.</p>	15	CO2
3	<p>MODULE – III</p> <p>3.1 Respiration – aerobic, anaerobic, glycolysis, HMP (outline only) Krebs cycle, electron transport system, oxidative phosphorylation, factors affecting respiration, respiratory quotient.</p> <p>3.2 Nitrogen metabolism: Importance of nitrogen in plant life, conversion of nitrate to ammonia by plants, biological nitrogen fixation – nitrogen fixing organisms, Legume – Rhizobium symbiosis.</p>	15	CO3
4	<p>MODULE – IV</p> <p>4.1 Growth and development – mode of action of phytohormones – Auxin, Gibberlin, Cytokinin –Practical application.</p> <p>4.2 Photomorphogenesis – photoperiodism, vernalization, phytochromes.</p> <p>4.3 Dormancy (Seed and Bud) physiology of seed germination, biological clock.</p>	15	CO4
5	<p>MODULE – V PLANT BIOCHEMISTRY</p> <p>5.1 Properties, structure and classification of Carbohydrates, Lipids, Proteins and Amino Acids.</p> <p>5.2 Elementary concept of bioenergetics – Entropy and free energy.</p> <p>5.3 Enzymes: properties, nomenclature and classification as per ECIUB (Enzyme Commission of the International Union of Biochemistry), cofactor, co-enzymes and mode of action, factors.</p>	15	CO5

TEXT BOOKS:

1. Jain JL, Sunjay Jain, et al., 2016. Fundamentals of Biochemistry. S.Chand Publications, New Delhi.
2. Jain,V.K., 2017. Fundamentals of Plant Physiology, S.Chand Publications,New Delhi.
3. U Satyanarayana. 2017. Biochemistry (5 Ed). Elsevier India.

REFERENCE BOOKS:

1. Salisbury F.B and Ross,C.N. 1995. Plant Physiology.CBS Publishers, New Delhi.
2. Noggle and Fritz, 1976. Introductory Plant Physiology,Prentice Hall, New Delhi
3. Hans-Walter Heldt and Birgit Piechulla. 2010. Plant Biochemistry (4 ed).Academic Press, USA.
4. David L. Nelson and Michael Cox , 2017. Lehninger :Principles of Biochemistry (7th ed.) W.H Freeman. USA.

WEBSITES:

<http://www.plantphysiol.org/>
<https://www.nature.com/subjects/plant-physiology>
<https://basicbiology.net/plants/physiology>

ASSESSMENT PATTERN**CIE- Continuous Internal Evaluation (40 Marks)**

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613623/1713620	PLANT BIOTECHNOLOGY	Core Paper : XIII	4				4

Year	Semester	CIA	ESE	Exam Hours
Third	Sixth	40	60	03

LEARNING OBJECTIVES:

The student will be able to understand general concepts Biotechnology and its applications in various areas. The student will be able to understand the process of Plant Tissue culture, use of bio products for environment protection, production of various products through biotechnology and various aspects of Bioinformatics.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Define biotechnology and evaluate its applications	K1
CO2	Apply plant tissue culture techniques in bringing out successful plant varieties	K1,K2
CO3	Recall various procedures to save the environment	K1
CO4	Explain industrial applications of microbes and utilization of enzymes for improvement of plants	K3
CO5	Assess the databases through computational biology	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	2	2	3	3	3	2	2	2	3	2	2
CO4	3	3	2	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	2	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	<p>MODULE – I</p> <p>1.1 Biotechnology – definition, history and scope. 1.2 Application of plant biotechnology in various fields. Agriculture 1.3 Biofertilizers & Biopesticides. 1.4 Medicine – Antibiotics (Penicillin) 1.5 Recombinant vaccines, insulin and interferon. 1.6 Transgenic plants for herbicide, pest, fungi and viral resistances.</p>	12	CO1
2	<p>MODULE – II</p> <p>2.1 Plant Cell and tissue culture- Totipotency, nutrient medium (MS and B5), root and shoot culture and its uses. 2.2 Protoplast culture – Isolation, purification, fusion (somatic hybrids), regeneration and advantages of protoplast fusion.</p>	12	CO2
3	<p>MODULE – III</p> <p>3.1 Environmental Biotechnology: Production of Biogas – biological treatment of sewage – Biological processing of industrial wastes; Dairy and tannery – microbial leaching. 3.2 Bio ethics- IPR, Patenting and biosafety.</p>	12	CO3
4	<p>MODULE – IV</p> <p>4.1 Production of primary metabolites – Ethanol production by Yeast, Citric acid production by <i>Aspergillus niger</i>. 4.2 Enzymes from microbes and their application – amylase, Proteases, Renin, Pectinase and glucose oxidase. 4.3 Improvement of Plants: alkaloid production, luminescent plants.</p>	12	CO4
5	<p>MODULE – V</p> <p>5.1 Introduction to Bioinformatics: Biological database, Human genome project. 5.2 Introduction to bioremediation – types of bioremediation – factors influencing bioremediation. 5.3 Biofuel. 5.4 Single cell protein and their nutritional value.</p>	12	CO5

TEXT BOOKS:

1. Ignacimuthu, S., 1996. Basic Biotechnology, Tata Mc Graw Hill publishing Co., Ltd., New Delhi.

2. Satyanarayana U.,2008. Books & Allied Ltd. Books & Allied Ltd, Kolkata.
3. Gupta PK.,2009. Elements of Biotechnology. Rastogi Publications.Uttar Pradesh.
4. Ignacimuthu SJS.,2012. Biotechnology: An Introduction. Narosa Book Distributors Pvt Ltd. Chennai.
5. Dubey RC.,2014. A Textbook of Biotechnology. S.Chand Publications, New Delhi.
6. Gupta PK.,2015. Plant Biotechnology. Rastogi Publications.Uttar Pradesh.

REFERENCE BOOKS:

1. Dixon,R.A. 1985, Plant cell culture – A Practical Approach. IRL press, Oxford.
2. Butcher, D.N., and D.S.Ingram, 1982 – Plant Tissue Culture . Oxford.
3. Kumar H.D., 1993 A Text book of Biotechnology, East West Affiliated Press Ltd., New Delhi.
4. Jogdand,SN, 1997. Gene Biotechnology, Himalaya Publishing House, New Delhi.

WEBSITES:

<https://nifa.usda.gov/plant-biotechnology>

<http://biovegen.org/en/page.cfm?id=49&title=plant-biotechnology-and-its-importance#.XeAMvIMzbIU>

<https://archive.bio.org/articles/background-information-plant-biotechnology>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20

Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1713623	PRACTICAL –III (Plant Morphology, Taxonomy & Economic Botany, Plant Anatomy & Embryology, Cell Biology & Molecular Biology, Genetics, Plant Breeding & Biostatistics)	Core Paper : XIV			4		4

Year	Semester	CIA	ESE	Exam Hours
Third	Fifth	40	60	03

LEARNING OBJECTIVES:

At the end of the Course, the student will be able to understand the morphology, taxonomy, anatomy, embryology of plants. The student will be able to identify various cellular organelles, genetics, methods of plant improvement and perform statistical calculations.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Identify the different parts of flowering plants	K1,K2
CO2	Discuss the vegetative and reproductive characters of selected families of flowering plants	K2
CO3	Examine the Internal vegetative structure and reproductive stages of Dicot and monocot plants	K3
CO4	Outline the structures of cell organelles	K1
CO5	Evaluate various genetic and statistical problems	K1,K2,K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	2	3	3	3	2	2	2	3	3	3	2	3
CO2	3	3	3	3	3	2	2	3	3	3	3	2	2

CO3	3	3	2	3	3	2	2	3	3	3	3	2	2
CO4	3	2	2	3	3	2	2	2	3	3	2	2	2
CO5	3	2	3	2	3	3	2	2	3	3	2	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

1. Study of different types of roots, stem, inflorescence, flowers and fruits
2. Derivation of family (family identification – general)
3. Technical description of the range of vegetative and floral characters of plants belonging to the families mentioned syllabus.
4. Submission of Herbarium (15 sheets of weeds only) with field note book and Record note book.
5. Economic uses of plants and plant parts included under theory syllabus.
6. Field trips to places within the state for five days for plant collection and also to study the plants in their natural habitats.
7. Types of simple and complex tissue.
8. Types of stomata and Trichomes and special epidermal cells.
9. Internal structure of Dicot and monocot stem and aerial root
10. Anomalous secondary growth in the stems:*Nyctanthes*, *Boerhaavia* and *Dracena*.
11. Internal structure of dicot and monocot Leaf.
12. T.S. of young and mature anther (Permanent slide only)
13. Observation of pollinia (Permanent slide only)
14. Types of Ovule(Permanent slide only)
15. Types of endosperm (Permanent slide only)
16. Stages in development of embryo of Capsella and Najas (Permanent slide only)
17. Study of structure of plant cell organelles from electron micrographs and standard publication.
18. Squash – Onion root tip – Mitosis.
19. Genetic problems – test cross, back cross and allelic interactions.
20. Biostatistical Problems covered in the theory.
21. Gene mapping – 3 point test cross.
22. Models/photographs/charts/equipment/chemicals.
23. a) Any mutagen b) Protein synthesis c) DNA structure & replication d) t-RNA structure.
24. Emasculation techniques.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	Class room Practical's	Record Submission	Attendance
Marks (out of 40)	20	15	5
Remember	5		
Understand	5		
Apply	5	15	
Analyze	5		
Evaluate			
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1713624	PRACTICAL -IV (Plant Ecology & Phytogeography, Plant Physiology & Plant Biochemistry, Plant Biotechnology)	Core Paper : XV			6		3

Year	Semester	CIA	ESE	Exam Hours
Third	Sixth	40	60	03

LEARNING OBJECTIVES:

The student will be able to understand the ecological features of plants and identify phytogeographical regions. The student will be able to carry out biochemistry experiments and will be able to demonstrate plant physiology and plant biotechnology experiments.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Examine the internal structure of plants growing in different habitats	K1, K2
CO2	Outline the Phyto- geographical regions of India	K1
CO3	Apply and evaluate the various physiological experiments	K2, K3
CO4	Estimate some biochemical components	K2
CO5	Prepare medium for plant tissue culture	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	2	2	3	3	2	2	3	2	2	2	2
CO2	3	2	2	2	3	3	2	3	3	2	3	3	3

CO3	3	3	3	3	3	2	3	2	3	3	2	2	3
CO4	3	3	3	3	3	2	3	2	3	3	2	2	3
CO5	3	3	3	3	2	2	3	2	3	3	2	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

1. Study of morphological and anatomical adaptations of locally available hydrophytes, halophytes, xerophytes and epiphytes.
Hydrophytes : *Nymphaea, Eichornia*
Xerophytes : *Nerium, Casuarina*
Halophytes: *Avicennia, Rhizophora*
Epiphyte : *Vanda*.
2. Map of Phyto geographical regions of India.
3. Determination of water potential by Plasmolytic methods.
4. Effect of Temperature and Chemicals on membrane permeability.
5. Determination of percentage of viability of seeds with Tetrazolium chloride.
6. Separation of plant pigments by Paper Chromatography.
7. Study of the rate of photosynthesis under different wavelengths [Wilmot's Bubbler]
8. Estimation of carbohydrates, protein and total lipids.
9. Extraction procedure using soxhlet apparatus - **Demonstration**
10. Measurement of growth of plants (Arch – Auxinometer) - **Demonstration**
11. Study of rate of transpiration under different environmental factors [Gangong's Potometer] - **Demonstration**
12. Plant growth regulators – **Demonstration**
13. Sterilization techniques in plant tissue culture- **Demonstration**
14. MS – Media preparation - **Demonstration**
15. Callus induction, Explant – **Demonstration**

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	Class room Practical's	Record Submission	Attendance
Marks (out of 40)	20	15	5
Remember	5		
Understand	5		
Apply	5	15	
Analyze	5		
Evaluate			
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613624/1713621	HERBAL SCIENCE AND ETHNOBOTANY	Core Elective - II	5				5

Year	Semester	CIA	ESE	Exam Hours
Third	Sixth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to explain the importance and usage of herbal drugs in Indian systems of medicine. The student will be able to know some medicinal plants and their uses. To provide overview of ethnobotany & distribution of tribes. The last part of the course will enable the student to know the methodologies of Ethnobotanical studies and tribal medicine.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Understand different Indian Systems of Medicine	K1, K2
C02	Acquire Knowledge about some Medicinal uses of Plants	K1
C03	Understand the importance and history of ethnobotany	K1, K2
C04	Acquire Knowledge about tribes of Tamil Nadu	K1
C05	Apply methodologies for Ethnobotanical Studies	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
C01	3	2	3	3	3	3	3	2	3	2	3	3	3

CO2	3	3	3	2	3	3	2	3	3	3	3	3	2
CO3	3	2	2	2	3	3	2	2	3	2	2	2	3
CO4	3	2	2	2	3	3	2	3	3	2	2	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	<p>MODULE – I HERBAL SCIENCE: 1.1Importance and usage of herbal drugs in Indian systems of Medicine - Siddha, Ayurveda, Homeopathy and Unani. 1.2Classification of Crude drugs. 1.3Natural food for human welfare – Antioxidants 1.4 Antiaging foods 1.5 Herbs to prevent and control Diabetes 1.6 Carcinoma and Cardiac arrest.</p>	15	CO1
2	<p>MODULE – II 2.1Study of some plants of medicinal value – Binomial, Common name and Medicinal Uses. <i>Acalypha indica, Acorus calamus, Aloe vera, Azadirachta indica, Allium cepa, Andrographis paniculata, Coriandrum sativum, Eclipta alba, Emblica officinalis, Hemidesmus indicus, Ocimum santum, Phyllanthus amarus, Ricinus communis, Vinca rosea,, Syzygium aromaticum, Terminalia arjuna, and Zingiber officinale</i></p>	15	CO2
3	<p>MODULE – III ETHNOBOTANY: 3.1Concepts and definitions. 3.2Subdisciplines of ethnobotany. 3.3Interdisciplinary approaches. 3.4Importance of ethnobotany. 3.5History of ethnobotany: A brief history of the ethnobotanical studies in the world and in India.</p>	15	CO3
4	<p>MODULE – IV 4.1Distribution of Tribes in India. 4.2Basic knowledge of following tribes of Tamil Nadu: Irulas, Kanis, Paliyars and Malayalis.</p>	15	CO4
5	<p>MODULE – V 5.1Methodology of Ethnobotanical studies. a) Field work b) Herbarium c) Ancient Literature d) Temples and sacred places. 5.2Prior Informed Consent, Interviews and Questionnaire methods, choice of resource persons.</p>	15	CO5

	5.3Plants used by the tribal: a) Food plants b) Intoxicants and Beverages c) Miscellaneous uses.		
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TEXT BOOKS:

1. Jain S. K. 1989. Methods and approaches in Ethnobotany, Society of Ethnobotanists, Lucknow.
2. Ministry of Environment and Forests. 1994. Ethnobiology in India. A status Report. All India Coordinated Research Project on Ethnobiology. Ministry of Environment and Forests. New Delhi.
3. Murugesh, 2018. Text Book of Pharmacognosy, Sathya Publishers.

REFERENCE BOOKS:

1. Wallis, T. E. 2005. Text book of Pharmacognosy (5th Ed.), CBS Publishers, New Delhi.
2. Jain S.K. 1991. Contributions to Indian Ethnobotany. Scientific Publishers. Jodhpur.

WEBSITES:

- <http://abc.herbalgram.org/site/PageServer?pagename=Terminology>
- <https://www.intechopen.com/books/herbal-medicine/introductory-chapter-introduction-to-herbal-medicine>
- <http://botanicaldimensions.org/what-is-ethnobotany/>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
1613625/1713622	MICROTECHNIQUE	Core Elective - III	5				5

Year	Semester	CIA	ESE	Exam Hours
Third	Sixth	40	60	03

LEARNING OBJECTIVES:

On taking this course the student will be able to understand the working principle and applications of light and electron microscope. The student will also be able to understand the working mechanism of rotary and sledge microtome.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Analyze various types of Microscope	K2
C02	Explain different sectioning procedures and specimen preparation	K2,K3
C03	Compare types of microtome and staining methods	K1,K2,K3
C04	Formulate fixatives and mount preparation	K3
C05	Assess specific micro techniques	K2

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	2	2	3	3	3	2	3	3
CO3	3	3	3	3	2	3	2	3	3	3	2	3	3
CO4	3	3	3	3	2	3	2	3	3	3	2	3	3
CO5	3	2	3	3	3	3	2	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I 1.1Light microscope – History and Optical principles 1.2Compound microscope –Optical principles. 1.3Polarizing and Phase Contrast Microscopy- principles 1.4Transmission Electron Microscopy	15	CO1
2	MODULE – II 2.1Sectioning – Free hand section 2.2Microtomy. 2.3Preparation of specimens for TEM – fixatives – Glutar – aldehyde and osmium tetraoxide 2.4Embedding – spur, Epan, BEEM capsules. 2.5Ultramicrotomy – Knives – Glass and diamond, specimens support – grid.	15	CO2
3	MODULE – III 3.1Microtome – rotary and sledge (wood microtome) 3.2Stains & Methods of Staining (Progressive and counter staining; single and double staining; positive and negative staining).	15	CO3
4	MODULE – IV 4.1Fixatives – FAA and Crony’s fluid. 4.2Dehydration, Infiltration, preparation of paraffin block 4.3Whole mount preparations – Algae and fungi	15	CO4
5	MODULE – V 5.1Special techniques: Smear, Squash & Maceration.	15	CO5

TEXT BOOKS:

1. Prasad, M. K & Krishna Prasad, M, 2000, Outlines of Microtechnique, Emkay publications.
2. Annie Ragland, Arumugam. N, 2016, Fundamentals of Plant Anatomy and Microtechniques, Saras Publication.

REFERENCE BOOKS:

1. Johanson . D.A. 1940. Plant Microtechnique Tata Mc graw
2. Gray P, 1964. Handbook of Basic Microtechniques- Mcgraw Hill.
3. Edward Chee Tak Yeung, Claudio Stasolla, Michael John Sumner, 2015. Plant Microtechniques and Protocols, Springer Nature, USA.

WEBSITES:

<https://www.intechopen.com/books/histology/introductory-chapter-histological-microtechniques>

<https://prezi.com/pzuxw0rxlzyx/types-of-microscopes-microtechniques/>

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
	ORGANIC FARMING	Open Elective : I	2				3

Year	Semester	CIA	ESE	Exam Hours
		40	60	03

LEARNING OBJECTIVES:

At the end of the Course, the student will be able to understand various aspects of organic farming with preference to their economic importance along with practices of its cultivation and scope. The students will get the knowledge of organic manure and Bio fertilizers. That knowledge will help them to get self-employment.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
C01	Understand the basics of Organic farming.	K2
C02	Identify the properties of soil and its pollution.	K2, K3
C03	Demonstrate and Apply the importance of Bio-fertilizers and Organic manure.	K2, K3
C04	Describe the different pest and crop protection measures.	K1
C05	Explain the concepts of marketing and certification of Organic farming.	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	3	3	2	2	3
CO2	3	3	2	3	3	3	2	3	3	3	2	3	3
CO3	3	3	2	3	3	3	2	3	3	2	3	3	3
CO4	3	2	2	3	3	3	3	3	3	2	3	3	3
CO5	3	3	2	2	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	<p style="text-align: center;"><u>ORGANIC FARMING</u></p> <p>MODULE – I</p> <p>1.1 Organic farming – definition, basic concept of organic farming 1.2 Sustainable agriculture practice – crop rotation, crop diversification, mixed cropping.</p>	15	CO1
2	<p>MODULE – II</p> <p>2.1 Soil – physical, chemical properties. 2.2 Biomagnification, consequences of land pollution – damage to soil and crops, heavy metal contamination.</p>	15	CO2
3	<p>MODULE – III</p> <p>3.1 Organic manures – organic residue, chemical nature of organic manure, green manure, importance of green manure, crops of green manure, oil cake.</p>	15	CO3
4	<p>MODULE – IV</p> <p>4.1 Biofertilizers–classification, nitrogen fixers–<i>Rhizobium</i>, <i>Azotobacter</i>, cyanobacteria, <i>Azolla</i>, <i>Frankia</i>. <i>Azospirillum</i> and Vesicular Arbuscular Mycorrhizae (VAM) Phosphate solubilizing Bacteria, Potash solubilizing Bacteria. 4.2 Plant Growth Promoters- <i>Rhizobacter</i>, Panchagavya,. Auxin, Gibberillin.</p>	15	CO4

5	MODULE – V 5.1 Biological Control - <i>Bacillus, Pseudomonas, Trichoderma</i> . 5.2 Biopesticides- <i>Neem, Pongamia</i> , Nuclear Polyhedrosis Virus (NPV). 5.3 Certification of Organic Products and marketing.	15	CO5
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TEXT BOOKS:

1. Sharma, A.K., 2003. Biofertilizers for sustainable agriculture, Agrobios.
2. NIIR Board, 2004. The Complete Technology Book on Biofertilizer and Organic Farming, National Institute of Industrial Research.

REFERENCE BOOKS:

3. Palaniappan. S.P, Annadurai, K, 2010. Organic Farming: Theory and Practice, Scientific Publishers Journals.
4. Bansal, M. 2020. Basics of Organic Farming, CBS.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New – Delhi.

E- RESOURCES:

1. <https://nptel.ac.in/courses/126105014/#>
2. http://agritech.tnau.ac.in/org_farm/orgfarm_index.html

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		

Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
	BIOINFORMATICS	Open Elective : II	2				3

Year	Semester	CIA	ESE	Exam Hours
		40	60	03

LEARNING OBJECTIVES:

At the end of the Course, the student will be able to understand the targets of drug discovery. They will be able to understand new algorithms and analysis methods. The subject will provide knowledge about structural, functional relationships and importance of molecular evolution.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Understand the concept of Bioinformatics	K2
CO2	Knowledge about biological databases.	K1
CO3	Demonstrate various tools associated with databases	K2

TEXT BOOKS:

1. Ignacimuthu S J, 2004. Basic Bioinformatics, Narosa Publishing House.
2. Rastogi S.C , 2013. Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, PHI.
3. Attwood T. K, 2007. Introduction to Bioinformatics, Pearson.

REFERENCE BOOKS:

1. Baxevanis A D , Francis Ouellette B F, 2009. Bioinformatics, Wiley.
2. Ghosh Z. and Bibekanand M., 2008. Bioinformatics: Principles and Applications. Oxford University Press.

E- RESOURCES:

1. <https://www.ncbi.nlm.nih.gov/pubmed/11552348>
2. <https://nptel.ac.in/courses/102106065/>

ASSESSMENT PATTERN**CIE- Continuous Internal Evaluation (40 Marks)**

Bloom's Category	CIA	Third Component (10 Mrks)	Attendance
		Assignments/poster presentation/ power point presentation/group Discussion/ filed visits/quiz	
Marks (out of 40)	25	10	5
Remember	5	5	
Understand	5		
Apply	5	5	
Analyze	5		
Evaluate	5		
Create			

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
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Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

Course Code	Course Title	Category	L	T	P	S	Credits
	SEAWEED TECHNOLOGY	Open Elective : III	2				3

Year	Semester	CIA	ESE	Exam Hours
		40	60	03

LEARNING OBJECTIVES:

At the end of the Course, the student will be able to understand seaweeds with preference to their economic importance along with practices of its cultivation and scope. The students will get self-employment by doing such farming.

Course Outcomes

At the end of the Course, the Student will be able to:

	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO1	Understand the basics of Seaweeds.	K2
CO2	Discuss the structure, reproduction and life history of seaweeds.	K2, K3

CO3	Identify seaweed resources in India and abroad. Demonstrate the importance of seaweed fertilizers.	K1, K2
CO4	Illustrate the methods of commercial cultivation of seaweeds and discuss the issues and problems related to seaweed cultivation.	K1, K3
CO5	Understand and Apply the commercial uses of seaweeds.	K2, K3

K1 - Knowledge

K2 - Understand

K3 - Apply

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	2	2	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	2	3	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	2	2	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs.	COs
1	MODULE – I 1.1 Introduction to Seaweed 1.2 Structure, Reproduction and life history of seaweeds.	15	CO1
2	MODULE – II 2.1 Ecology of Seaweeds: Distribution, Nutrients and Environment 2.2 Seaweed resources in India and abroad.	15	CO2
3	MODULE – III 3.1 Biochemistry: Polysaccharides, Bioactive compounds, Chemical constituents and Growth regulators in Seaweeds. 3.2 Seaweed fertilizers – Liquid, Powder. 3.3 Production and application of seaweed in Agriculture and Horticulture	15	CO3
4	MODULE – IV 4.1 Methods of commercial cultivation of Seaweeds. - <i>In situ</i> and <i>ex situ</i> . 4.2 Issues and Problems- Native Problems, Positive and negative impacts. 4.3 Case study- Livelihood of Fisherman, Cultivators.	15	CO4

5	MODULE – V 5.1 Commercial uses of Seaweeds – Agar, Carrageenan, Alginic acid and their uses in various industries. 5.2 Common methods for extraction of various cell wall Polysaccharides in seaweeds.	15	CO5
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TEXT BOOKS:

1. Sahoo D, 2010. Common Seaweeds of India, I K International Publishing House Pvt. Ltd.
2. Jha B, 2009. Seaweeds of India: the diversity and distribution of seaweeds of the Gujarat coast, Springer.

REFERENCE BOOKS:

1. Fritsch, F.E. 1945. Structure and Reproduction of Algae , Vol. I & II, Cambridge University Press.
2. Sharma. O. P, 2017. Algae, Mc-Graw Hill Education.

E- RESOURCES:

1. <http://aquagri.in/seaweed-cultivation>
2. <https://vikaspedia.in/agriculture/policies-and-schemes/fisheries-related/seaweed-culture>
3. www.algaebase.org
4. www.isaseaweed.org