

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A) VISAKHAPATNAM

DEPARTMENT OF BOTANY

PROPOSED SYLLABUS FOR B.Sc BOTANY HONOURS

(SINGLE MAJOR)

IN UNDERGRADUATE DEGREE PROGRAMME

UNDER AUTONOMY

2023 - 2024

BOARD OF STUDIES

IN

B.Sc BOTANY 2023-2024

DEPARTMENT OF BOTANY

SYLLABUS FOR B.Sc BOTANY HONOURS

(SINGLE MAJOR)

Approved in B.O.S for the Academic Year 2023-2024

(Dt:11-09-2023)



Dr.V.S.Krishna Govt. Degree College (Autonomous), (Accredited with 'A' Grade by NAAC) Visakhapatnam 530013, ANDHRA PRADESH

Dr.V.S.Krishna Govt. Degree College (Autonomous), Visakhapatnam Department of Botany

BOS Meeting

The Dept of Botany has conducted BOS meeting on 11-09-2023 at 10.30 AM with Dr. B. Chandramouli, Lecturer in-Charge in the chair along with the following members to discuss the changes in curriculum of B.Sc. Botany, single major subject for I-and II semesters only. $T \uparrow_{\delta} \overline{\mathcal{Y}}$. Semesters

The curriculum designed and approved by BOS committee and the changes in curriculum will be implemented from 2023-24 academic year onwards.

MEMBER	NAME & DESIGNATION	SIGNATURE
Head of the Department (Chairman)	Dr. B. Chandramouli	funto
Department Faculty members	Dr. P. Swamy Naidu	02
	Dr. S. Padmavathi	S.Pade C
	Dr.V. Padmaja	V. Porlowi
	Dr. AHD Pushpalatha	A. A. Opukar
	Smt. GRNS Sujatha	Anul
Subject Expert	Prof. S.B. Padal	
(University Nominee)	Department of Botany, AU	N-dul
and the state of the	Visakhapatnam	·
Subject Expert	Dr. A. Srinivasa Rao, HOD	
from outside the parent	Dept of Botany	A
university)	Govt. College (A), Rajahmundry	
	Adikavi Nannayya University	
Subject Expert	Sri. KVGK. Vara Prasad	1
from outside the parent	HOD, Dept. of Botany	the entrail
university)	Govt. Degree College (A),Tuni	-
	Adikavi Nannayya University	1
Industrial Expert	Dr.U.V Ravi Sankar, Director	Ruh A.
	MicGene Lab, Visakhapatnam	rangenta
Member from Alumni	Smt B.Kumari	
	Lecturer in Botany	R. Keeman
	Govt Degree College (W),	0 100 .
	Marripalem	
Coordinator,	Dr. D. Shravan Kumar	
Academic Council	Reader In Physics	2 (nh
Chairperson,	Dr. I. Vijaya Babu	
Academic Council	Principal	5. 119 202

PRINCIPAL Dr. V.S.Krishna Govt. Degree College(A) Visakhapatnam-530013

DR. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM DEPARTMENT OF BOTANY

Programmes: For B.Sc (Botany) w.e.f. 2023-24 Academic year onwards Objectives of the Programmes of B.S.c Botany Single major

- 1. To create awareness on all fundamental aspects of biological sciences with an emphasis on basic and applied aspects of Botany for the beginners
- 2. To enhance the knowledge about diversity in all cryptogams (spore plants)
- 3. To create an awareness on economic importance and ecological significance of Algae, Fungi, Lichens , Bryophytes and Pteridophytes .
- 4. To study structure of viruses and bacteria; diagnosis and control methods of plant diseases caused by these pathogens
- 5. To study various plant tissues and tissue systems and understanding anatomy of the seed plants with emphasis on anomalous secondary growth in different plants
- 6. To create awareness on classification on flowering plants
- 7. To study the morphology and floral characters of some flowering plants
- 8. To know the importance of flowering plants around the habitats
- 9. To increase the ability of analysis of plant species with classification
- 10. To create awareness on economic importance of flowering plants
- 11. To study and understands various fundamental aspects in Embryology
- 12. To study the growth and development patterns of plant
- 13. To study and understands different Physiological phenomenons and functions in Plants
- 14. To understand the biochemical pathways such as Photosynthesis, Respiration
- 15. To study the basic concepts of Ecology, Population and Community
- 16. To study the functions and role of cell and cell organelles
- 17. To understand the concept of gene, Laws of Heredity and Hybridization.
- 18. To study the geographical distribution of plants
- 19. To study and understand medicinal values of different medicinal plants

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Students graduating with a B.SC should be able to

POs	Programme Outcomes
PO1	Critical Thinking: Ability to take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO2	Effective Communication: Ability to speak, read, write, and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
PO3	Social Interaction: Ability to elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO4	Effective Citizenship: Ability to demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO5	Ethics: Ability to recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO6	Environment and Sustainability: Ability to understand the issues of environmental contexts and sustainable Development.
PO7	Employability skills: Equipping graduates with the essential abilities and knowledge to excel in their choosen careers.
PO8	Entrepreneurship skills: Seeks to empower students with the competencies needed to be successful entrepreneours, enabling them to launch, operate, and innovate in their own businesses or entrepreneurial ventures.
PO9	Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

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Program Specific Outcomes (PSOs)

PSOs	Program Specific Outcomes (PSO)
PSO1	Analyze the relationships among animals, plants and microbes
PSO2.	Understand the nature and basic concepts of anatomy, embryology and Plant Ecology.
PSO3	Understand structure of Cell and functions of cell organelles. Plant breeding ; Biochemistry , Plant Physiology and Plant Biotechnology; Economic Botany.
PSO4	Undertand the concept gene, Heridity and Hybridization
PSO5	Know and understand different Physiological functions and Biochemical pathways in Plants and cell.
PSO6	Understand, identify and utilize different Economically useful plants in life
PSO7	Perform procedures as per laboratory standards in the areas of plant Anatomy, Embryology, Ecology, Cell Biology, Plant Breeding, Plant Physiology and Plant Biotechnology,

DR. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM (ACCREDITED WITH "A"GRADE BY NAAC) B.Sc HONOURS DEGREE IN BOTANY (SINGLE MAJOR) (With effect from AY 2023-24 onwards)

Course structure

Year	Semester	Course	Title		No.of Credits	Course code		
	т	1	Introduction to Classical Biology	5	4	23BSBM11		
T	1	2	Introduction to Applied Biology	5	4	23BSBM12		
1		2	Non-vascular Plants –(T)	3	3			
	II	3	Non-vascular Plants –(P)	2	1			
		4	Origin of Life and Diversity of Microbes –(T)	3	3			
		4	Origin of Life and Diversity of Microbes –(P)	2	1	s Course code s 23BSBM11 23BSBM12 23BSBM1 23BSBM1		
		5	Vascular Plants –(T)	3	3			
		5	Vascular Plants –(P)	2	1			
		6	Plant Pathology and Plant Diseases-(T)	3	3			
	III	0	Plant Pathology and Plant Diseases –(P)	2	1			
		7	Plant Breeding–(T)					
		/	2	1				
		0	Plant Biotechnology–(T)	3	3			
I I		8	Plant Biotechnology–(P)	2	1			
		9	Anatomy and Embryology of Angiosperms– (T)	3	3			
	IV		Anatomy and Embryology of Angiosperms- (P)	2	1			
		10	8Plant Biotechnology-(T)339Plant Biotechnology-(P)219Anatomy and Embryology of Angiosperms- (T)3310Plant Ecology, Biodiversity andPhytogeography-(T)3310Plant Ecology, Biodiversity Plant Ecology, Biodiversity 					
		10	Plant Ecology, Biodiversity andPhytogeography–(P)	2	1			
		11	Plant Resources and Utilization–(T)	3	3			
			Plant Resources and Utilization–(P)	2	1			
		10	Cell Biology and Genetics–(T)	3	3			
		12	Cell Biology and Genetics–(P)	2	1			
		10	Plant Physiology and Metabolism–(T)	3	3			
		13	Plant Physiology and Metabolism–(P)	2	1			
		144	Organic Farming–(T)	3	3			
		14 A	Organic Farming–(P)	2	1			
III	V	15 4	Mushroom Culture Technology–(T)	3	3			
		15 A	Mushroom Culture Technology–(P)	2	1			

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM DEPARTMENT OF BOTANY

(BSc Botany Single Major with effect from 2023-24 for BSc (Botany) Academic Year)

The Board of Studies in Botany for the academic year 2023 - 2024 convened on 11-09- 2023 in Dept. of Botany, Dr. V.S Krishna Govt.Degree College (A), Visakhapatnam.

Agenda:

- 1. To discuss and approve the Botany Single Major syllabus for I, II, III, IV & V semesters changed as per NEP 2020 policy and CBCS and semester system w.e.f 2023-2024.
- 2. Scheme of examination for Both Internal and external examinations
- 3. Model question paper for theory and practical of all papers
- 4. To discuss and approve the weightage to be given to each paper
- 5. Panel of paper setters and examiners
- 6. Other academic activites of the Department
- 7. Any other suggestions with permission of Chairperson

RESOLUTIONS:

- 1. Resolved to approve the syllabus for the ,I, II, III,IV and V semesters from 2023-24 onwards as appended herewith for B.Sc Botany Single Major.
- 2. Resolved to approve the syllabus for both theory and Practical the I,II,III,IV and V semesters from 2023-24 onwards as appended herewith
- 3. As per the UGC Guidelines 4 years under graduation course Started in B.Sc. with Multiple
 - entries & exits. The student can join in I,III, IV semesters and if they want to exit it will be possible in II,IV,VI semesters
 - 4. Resolved to follow the following pattern for Examinations
- 5. The syllabus of each paper is divided into two parts. Each paper has 60% External (CIA) and 40% Internal Examinations for I, II, III, IV, and V Semesters.
 - 5. No Internal Examination /Semester Examination be conducted separately for the absentees a) Absentees will be awarded Zero marks
 - b) The minimum pass mark for the External Examination is 21. Candidate should get a total of 35 marks in Internal & External Examination put together for I, II, III, IV, & V semesters.
 - c) The pattern of semester Examination and practical for II, III, IV, and V, semesters is herewith appended
 - d) Practical Examination will be conducted at the end of each semester
 - 6. Resolved to approve the Model question papers for I, II, III, IV and V Semesters is here with appended
 - 7. Resolved to approve the panel of paper setters and Examiners as appended herewith
 - 8. Resolved to recommend a guest faculty in Botany which is a dire need for smooth running of the course classes.
- 9. Resolved to take 14A and 15A papers in V Semester for III Year.

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM (Affiliated to Andhra University) MINUTES OF THE BOARD OF STUDIES MEETING 2023-2024

The Board of Studies meeting on B.Sc Botany Single Major syllabus was conducted at Botany Department under the chairmanship of Dr. B. Chandramouli, Lecturer and In-Charge, Dept. of Botany . The BOS Committee includes Prof. S.B. Padal, University Nominee, AU, Visakhapatnam, Dr. A. Srinivasa Rao, Subject Expert, HOD, Dept. of Botany, Govt. College (A), Rajahmundry, Sri KVGK Vara Prasad, Subject Expert, HOD, Dept. of Botany, GOvt. Degree College (A), Tuni, Dr. UV Ravi Sankar, Industrial Expert, Director, MICGene Lab, Visakhapatnam, Smt. B. Kumari, Member from Alumni, Lecturer in Botany, Govt. Degree College (W), Marripalem, Dr. D. Shravan Kumar, Coordinator, Academic Council, Reader in Physics, and Dr. I. Vijaya Babu, Chairperson, Academic Council and Principal of Dr. VS. Krishna Govt. Degree College (A), Visakhapatnam, were met, discussed and resolved the following.

RESOLUTIONS

1. It is unanimously resolved to follow the B.Sc Botany Major Honours with Research Syllabus designed for I to V Semesters from 2023-24 onwards.

2. It is unanimously resolved to authorize the college to follow the proposed pattern of question papers in each Semester.

3. It is unanimously resolved to approve the panel of question paper setters.

4. It is resolved to implement 60% external and 40% internal assessment pattern for I to V Semesters.

5. It is unanimously resolved to distribute 40 marks for the internal assessment among Mid examinations, Assignment/Projects and Attendance.

6. It is resolved to approve and ratify the following courses w.e.f 2023-24 for the students joining in BSc Botany Honours with Research Program.

S. No.	Y e a	Seme ster	Major	Major Course Nos	Minor	MDCs	SECs	VAC	Add-on Course		
1	r I	1	General Major Courses	1	-	Indian History	Leadership skills				
							Communicati on skills				
3		2		3	Zoology 1		Marketing Skills				
4			Botany	4			Digital Literacy				
5 6		3	Honour	5 6	Zoology	Public Admini-			Manures		
7 8	II		S	7 8	2	stration	ICT				
9		4		9	Zoology 3	Funda- mentals	Tourism				
10				10	Zoology 4	of Economi cs	Guidance				
12 13				12 13	Zoology 5			Environ-	Mangroves		
14 15	III	5		14A	Zoology	-	-	mental Education			
10				13A	0						
18		6		APPRENTICESHIP							

a. Multi-Disciplinary Courses –

Resolved to offer and approve three Multi-Disciplinary Courses (MDCs) – One in Semester-1 i.e., Indian History, One in Semester – 3 (Public Administration) and One course in Semester – 4 (Fundamentals of Economics) for the students admitted during 2023-34 as ratified by the concerned departments.

Semester	No. of MDCs	Name of the LSC
1	1	Indian History
3	1	Public Administration
4	1	Fundamentals of Economics

8. Skill Enhancement Courses –

Resolved to offer and approve Six Skill Enhancement Courses – Two in Semester-1 i.e., Leadership Skills & Communication Skills, Two in II Semester i.e. Marketing Skills and Digital Literacy,One in Semester – 3 i.e. ICT and One in Semester-4 i.e. Tourism Guidance for the students admitted during 2023-24 as ratified by the concerned departments.

Semester	No. of SECs	Name of the SECs
1	2	Leadership skills & Communication Skills
2	2	Marketing Skills and Digital Literacy
3	1	ICT
4	1	Tourism Guidance

9. Value-added Courses –

Resolved to offer, approve and ratify the syllabus, model paper and blue-print of the Common Value-added course on "**Environmental Education**" in V Semester for the students admitted during 2023-24 as given by the AP State Council of Higher Education.

10. Add-on Courses –

Resolved to approve and ratify the syllabus, model paper and blue-print of the Add-on courses of Manures and a certificate course of Mangroves offered by the Department of Botany for the students admitted during 2023-24.

11. Internships & Apprenticeships –

Resolved to approve the implementation of first internship i.e. "Community Service Project" during the interim period (summer holidays) between first and second years, a second internship for 8 weeks during the interim period between second and third year and the third internship i.e. apprenticeship during the final year where students have to get trained in job skills related to the skill enhancement course they have chosen and submit a project. It is further resolved that for the 3rd internship, only 50% of the students shall be sent to industries while the remaining 50% shall be in the college being taught by the teachers and vice versa.

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Blue Print for all semester End Examinations and Question paper setting for I , II & III Years (w.e.f. 2023-24 Academic Year)

Learning level wise Weightage								
Bloom's Taxonomy level	Weightag e	Marks	Essay type	Short answer type				
Knowledge/ Remember	35%	35	2	3				
Understanding/ Comprehension	25%	25	2	1				
Application/	20%	20	1	2				
Analysis	15%	15	1	1				
Synthesis/ Evaluate	5%	5		1				
Total	100	50 (includin g choice 100 M)	3 availing internal choice	4 out of 8 questions				

		To be given	in the Questic	on paper	То	be Answered	
S.No	Type of Questions	No. of Questions	Marks Allotted to each Question	Total marks	No. of Questions	Marks Allotted to each Question	Total marks
1	<u>SECTION-A</u> SHORT QUESTIONS (SQ)	08	04	32	5	4	20
2	<u>SECTION-B</u> ESSAY QUESTIONS (EQ)	10	8	80	5	8	40
Total Questions & Total Marks =		18	-	112	10	-	60

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(Affiliated to Andhra University)

DEPARTMENT OF BOTANY LIST OF SUBJECT EXPERTS AND PAPER SETTERS OF BOTANY

S.No	Name of the Lecturer	Address				
1	Dr. NSN Swami	Govt. Degree College, Amadalavalasa,				
		Srikakulam				
2	Dr. A. Srinivasa Rao	Govt. College (A), Rajahmundry,				
		Adikavi Nannayya University				
3	Sri. KVGK. Vara Prasad	Govt. Degree College, (A) Tuni				
4	Dr. G. Jyothirmayee	Lecturer in Botany & HOD, SRVVSJB				
		Maharani College, Peddapuram, Kakinada				
		Dist.				
5	Dr. Sulakshna	Lecturer in Botany, ASD GDC (W), Kakinada				
6	Smt S. Rudrama Rani	Govt. Degree College (W), Srikakulam				

SEMESTER - I, COURSE: 1 INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives:

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes:

On Com	pletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Know the principles of classification and preservation of biodiversity	Level 1 (Knowledge)
CO 2	Understand the plant anatomical, physiological and reproductive processes.	Level 2 (Understanding)
CO 3	Knowledge on animal classification, physiology, embryonic development and theireconomic importance.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Compare and analyze, cell components, cell processes like cell division, heredity and molecular processes.	Level 3 (Application) Level 4 (Analysing)
CO 5	Comprehend the chemical principles in shaping and driving the macromolecules and lifeprocesses.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER - I, COURSE: 1 INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5 Credits: 4

Unit 1: Introduction to systematics, taxonomy and ecology.

1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.

1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.

1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.

1.4. Pollution and climate change.

Unit 2: Essentials of Botany.

2.1. The classification of plant kingdom.

2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).

2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.

2.4 Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

3.1. The classification of Kingdom Animalia and Chordata.

3.2. Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders.

3.3. Developmental Biology - Basic process of development (Gametogenesis, Fertilization,

Cleavage and Organogenesis)

3.4. Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.

4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.

4.3. Central Dogma of Molecular Biology.

4.4. Origin of life

Unit 5: Essentials of chemistry

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2. Branches of chemistry

5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.4. Green chemistry

Additional inputs: NIL

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.

2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.

3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.

4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.

5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.

6. Satyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.

9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

CO-PO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	1	1	2	3	2	3	1	-	2
CO 2	-	1	1	2	-	1	-	-	1
CO 3	1	1	-	1	-	1	-	-	1
CO 4	1	2	-	1	3	-	-	-	1
CO 5	1	-	-	-	-	-	-	-	-

CO-PSO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	1	1	1	2	1
CO 2	1	2	3	1	3	1	2
CO 3	3	2	3	1	2	2	3
CO 4	2	1	1	3	1	1	2
CO 5	2	1	2	3	2	1	1

ACTIVITIES:

- 1. Make a display chart of life cycle of nonflowering plants.
- 2. Make a display chart of life cycle of flowering plants.
- 3. Study of stomata.
- 4. Activity to prove that chlorophyll is essential for photosynthesis
- 5. Study of pollen grains.
- 6. Observation of pollen germination.

7. Ikebana.

- 8. Differentiate between edible and poisonous mushrooms.
- 9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
- 10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
- 11. Visit to Zoology Lab and observe different types of preservation of specimens
- 12. Hands-on experience of various equipment Microscopes, Centrifuge, pH Meter,

Electronic Weighing Balance, Laminar Air Flow

- 13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
- 14. List out different hormonal, genetic and physiological disorders from the society

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SEMESTER – I, COURSE: 1 INTRODUCTION TO CLASSICAL BIOLOGY

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 1. Rules of ICN
 - 2. Binomial Nomenclature
 - 3. Types of Transpiration
 - 4. Types of Pollination
 - 5. Chordata outline classification
 - 6. Importance of Aquaculture
 - 7. Differences between Prokaryotic and Eukaryotic cell
 - 8. Applications of Chemistry in daily life

Section - B

5×8= 40 MARKS

Answer any five of the following Questions, Draw neat and labelled diagrams wherever necessary

- a) Explain the principles of Binomial nomenclature? (Or)
 b) Write about Biodiversity and conservation?
- 2. a) Write an account on Microsporoogenesis? (Or)b) Write an essay on Principles of Mushroom Cultivation?
- 3. a) Explain about Gametogenesis and Fertilization? (Or)b) Write about Apiculture?
- 4. a) Explain the Structure of Chromosome ? (Or)b) Write Ultra structure of Eukaryotic cell?
- 5. a) Write about Ionic, Covalent and Non covalent bonds? (Or)

b) Write an essay on Green Chemistry?

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Question Bank

Short Questions (4 Marks)

Unit 1: Introduction to systematics, taxonomy and ecology.

- 1. Rules of ICN
- 2. Binomial Nomenclature
- 3. Concept of Ecosystem
- 4. Importance of Biodiversity and Conservation
- 5. Types of Pollution

Unit – 2: Essentials of Botany.

- 1. Types of Transpiration
- 2. Brief account of Phytohormones
- 3. Types of Pollination
- 4. Outline classification of Plant kingdom
- 5. Microsporogenesis
- 6. Importance of Photosynnthesis
- 7. Landscaping

Unit – 3: Essentials of Zoology

- 1. Chordata outline classification
- 2. Importance of Aquaculture
- 3. Endocrine glands
- 4. Sericulture
- 5. Aquaculture

Unit – 4: Cell biology, Genetics and Evolution

- 1. Differences between Prokaryotic and Eukaryotic cell
- 2. Cell theory
- 3. Cell cycle
- 4. Concept of Gene
- 5. Origin of life
- 6. Central Dogma

Unit – 5: Essentials of chemistry

- 1. Applications of Chemistry in daily life
- 2. Branches of Chemistry
- 3. Green Chemistry
- 4. Hydrophobic and Hydrogen Bonds

Essay Questions (8 Marks)

Unit – 1: Introduction to systematics, taxonomy and ecology.

- 1. What is Systematics? Explain Hierarchial stages?
- 2. Explain rules and Recommendations of ICN?
- 3. Explain the principles of Binomial nomenclature?
- 4. Write about Biodiversity and conservation?
- 5. What is Pollution? Explain its impact on Climate Change?

Unit – 2: Essentials of Botany.

- 1. Write an account on Microsporoogenesis?
- 2. Write an essay on Principles of Mushroom Cultivation?
- 3. Write an account on Phytohormones?
- 4. Explain Light phase of Photosynthesis?
- 5. Write about Glycolysis?

Unit – 3: Essentials of Zoology

- 1. Explain about Gametogenesis and Fertilization?
- 2. Write about Apiculture?
- 3. Write about Endocrine glands, Hormones and disorders?
- 4. Applications of Aquaculture?
- 5. Explain Cleavage and Organogenesis?

Unit – 4: Cell biology, Genetics and Evolution

- 1. Explain the Structure of Chromosome?
- 2. Write Ultra structure of Eukaryotic cell?
- 3. Explain Cell Cycle?
- 4. Describe Central Dogma theory?
- 5. Explain Origin of Life?

Unit – 5: Essentials of chemistry

- 1. Write about Ionic, Covalent and Non covalent bonds?
- 2. Write an essay on Green Chemistry?
- 3. Explain Scope and Applications of Chemistry in daily life?

SEMESTER – I, COURSE: 2 INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives:

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

On Co	mpletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Learn the history, ultrastructure, diversity and importance of microorganisms.	Level 1 (Knowledge)
CO 2	Understand the structure and functions of macromolecules.	Level 2 (Understanding)
CO 3	Knowledge on biotechnology principles and its applications in food and medicine.	Level 1 (Knowledge) Level 3 (Application)
CO 4	Outline the techniques, tools and their uses in diagnosis and therapy.	Level 1 (Knowledge) Level 3 (Application) Level 4 (Analysing)
CO 5	Demonstrate the bioinformatics and statistical tools in comprehending the complexbiological data.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER – I, COURSE: 2 INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5

Credits: 4

Unit 1: Essentials of Microbiology and Immunology

- 1.1.History and Major Milestones of Microbiology; Contributions of Edward Jenner, LouisPasteur, Robert Koch and Joseph Lister.
- 1.2.Groups of Microorganisms Structure and characteristics of Bacteria, Fungi, Archaea andVirus.
- 1.3. Applications of microorganisms in Food, Agriculture, Environment, and Industry.
- 1.4.Immune system Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I Carbohydrates, Lipids.
- 2.2. Biomolecules II Amino acids & Proteins.
- 2.3. Biomolecules III Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism Anabolism and catabolism.

Unit 3: Essentials of Biotechnology

- 3.1.History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
- 3.2.Environmental Biotechnology Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3.Genetic engineering Gene manipulation using restriction enzymes and cloning
- 3.4.vectors; Physical, chemical, and biological methods of gene transfer.
- 3.5.Transgenic plants Stress tolerant plants (biotic stress BT cotton, abiotic stress salttolerance). Transgenic animals Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

- 4.1. Applications in forensics PCR and DNA fingerprinting
- 4.2. Immunological techniques Immunoblotting and ELISA.
- 4.3. Monoclonal antibodies Applications in diagnosis and therapy.
- 4.4. Eugenics and Gene therapy.

Unit 5: Biostatistics and Bioinformatics

5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.

5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench.

Additional inputs: NIL

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.

6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.

 U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.

8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.

10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

CO-PO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	1	1	-	-	2	1	-	1
CO 2	1	-	-	-	-	1	-	-	1
CO 3	2	2	1	1	1	3	3	3	2
CO 4	2	1	2	1	1	-	2	2	1
CO 5	1	-	2	-	1	-	2	1	1

CO-PSO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	1	1	1	1	1	2
CO 2	2	1	2	1	1	1	2
CO 3	1	1	1	1	1	1	2
CO 4	1	1	2	2	1	1	1
CO 5	2	1	1	2	1	1	2

ACTIVITIES

- 1. Identification of given organism as harmful or beneficial.
- 2. Observation of microorganisms from house dust under microscope.
- 3. Finding microorganism from pond water.
- 4. Visit to a microbiology industry or biotech company.
- 5. Visit to a waste water treatment plant.
- 6. Retrieving a DNA or protein sequence of a gene'
- 7. Performing a BLAST analysis for DNA and protein.
- 8. Problems on biostatistics.

9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.

10. Demonstration on basic biotechnology lab equipment.

11. Preparation of 3D models of genetic engineering techniques.

- 12. Preparation of 3D models of transgenic plants and animals.
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SEMESTER – I, COURSE: 2 INTRODUCTION TO APPLIED BIOLOGY

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 2. Koch Postulates
 - 2. Structure of Bacteria cell
 - 3. Types of Lipids
 - 4. Biofertilizers
 - 5. Bt Cotton
 - 6. Applications of DNA Finger Printing
 - 8. Gene Bank

Section – B

5×8= 40 MARKS

Answer any five of the following Questions, Draw neat and labelled diagrams wherever necessary

- a) Explain applications of Microbes in Food and Agriculture? (Or)
 b) Weite choset Incomplete and Incomplete
 - b) Write about Immunity and types?
- 7. a) Describe Double helical structure of DNA? (Or)b) Write an essay on Types of RNA?
- 8. a) Explain the applications of Biotechnology in Industry and Pharmacy? (Or)b) Write about Biological method of Gene transfer?
- 9. a) Explain the mechanism of PCR ? (Or)b) Write applications of MAbs in Diagnosis and Therapy?
- 10. a) Write about Data collection and Sampling? (Or)

b) Write an essay on Genomics?

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Question Bank

Short Questions (4 Marks)

Unit 1: Essentials of Microbiology and Immunology

- 1. Contributions of Edward Jenner to Microbiology
- 2. Koch Postulates
- 3. Contributions of Louis Pasteur
- 4. Contributions of Joseph Lister
- 5. Structure of Bacteria cell
- 6. Characters of Archaea

Unit – 2: Essentials of Biochemistry

- 1. Carbohydrates
- 2. Types of Lipids
- 3. Aminoacids
- 4. Differences between Anabolism and Catabolism

Unit – 3: Essentials of Biotechnology

- 1. Bioremediation
- 2. Biofertilizers
- 3. Biofuels
- 4. Biopesticides
- 5. Restriction Enzymes
- 6. BT Cotton
- 7. Transgenic animals

Unit – 4: Analytical Tools and techniques in biology – Applications

- 1. PCR
- 2. Uses of DNA Finger Printing
- 3. Immunoblotting
- 4. ELISA
- 5. Gene therapy
- 6. Monoclonal antibodies

Unit – 5: Biostatistics and Bioinformatics

- 1. Genomics
- 2. Proteomics
- 3. Gene Bank
- 4. Protein 3D Structure
- 5. Types of Biological data
- 6. NCBI

Essay Questions (8 Marks)

Unit - 1: Essentials of Microbiology and Immunology

- 1. Write structure ans characters of Bacteria?
- 2. Explain applications of Microbes in Food and Agriculture?
- 3. Write about Immunity and types?

Unit – 2: Essentials of Biochemistry

- 1. Explain the protein structure?
- 2. Describe Double helical structure of DNA?
- 3. Write an essay on Types of RNA?

Unit – 3: Essentials of Biotechnology

- 1. Write Principles of Genetic Engineering?
- 2. Explain the applications of Biotechnology in Industry and Pharmacy?
 - 3. Write about Biological method of Gene transfer?
 - 4. Write an account on Transgenic Plants?

Unit – 4: Analytical Tools and techniques in biology – Applications

- 1. Explain the mechanism of PCR ?
- 2. Explain applications of DNA Finger Printing in Forensic field?
- 3. Write applications of MAbs in Diagnosis and Therapy?

Unit – 5: Biostatistics and Bioinformatics

- 1. Write about Data collection and Sampling?
- 2. Write an essay on Genomics?
- 3. Explain Protein 3D Structure?

SEMESTER – II, COURSE 3: NON-VASCULAR PLANTS (ALGAE, FUNGI, LICHENS AND BRYOPHYTES)

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To realize the characteristics and diversity of non-vascular plants.
- 2. To recognize the ecological and economic value of algae, fungi, lichens and bryophytes.
- 3. To inquire the habit, habitat, morphological features and life cycles of selected genera of non-vascular plants.

II. Learning Outcomes:

On Co	mpletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Compile the general characteristics of algae and their significance in nature.	Level 1 (Knowledge)
CO 2	Compare and contrast the characteristics of different groups of algae.	Level 2 (Understanding)
CO 3	Summarise the important features of fungi and their economic value.	Level 1 (Knowledge) Level 2 (Understanding) Level 3 (Application)
CO 4	Distinguish the characteristics of different groups of fungi.	Level 3 (Application) Level 4 (Analysing)
CO 5	Elaborate the features and significance of amphibians of plant kingdom.	Level 1 (Knowledge) Level 3 (Applying) Level 4 (Analysing)
CO6	Explain the diversity among non-vascular plants.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER – II, COURSE 3: NON-VASCULAR PLANTS (ALGAE, FUNGI, LICHENS AND BRYOPHYTES)

Credits -3

Unit-1: Introduction to Algae

- 1. General Characteristics of algae: Occurrence and distribution, cell structure, pigments, flagella and reserve food material.
- 2. Classification of algae: F.E.Fritsch (1935) and Lee (2008)
- 3. Thallus organization and life cycles in algae.
- 4. Ecological and economic importance of algae.

Unit-2: Biology of selected Algae

- 1. Occurrence, structure, reproduction and life cycle of:
 - (a) Chlorophyceae: Spirogyra (b) Phaeophyceae: Ectocarpus
 - (c) Xanthophyceae: Vaucheria (d) Rhodophyceae: Polysiphonia
- 2. A brief account of Bacillariophyceae
- 3. Culture and cultivation of *Chlorella*

Unit-3: Introduction to Fungi

- 1. General characteristics of fungi and Ainsworth (1973) classification.
- 2. Thallus organization and nutrition in fungi.
- 3. Reproduction in fungi (asexual and sexual); Heterothallism and parasexuality.
- 4. Ecological and economic importance of fungi.

Unit-4: Biology of selected Fungi

- 1. Occurrence, structure, reproduction and life cycle of:
 - (a) Mastigomycotina: Phytophthora (b) Zygomycotina: Rhizopus
 - (c) Ascomycotina: Penicillium (d) Basidiomycotina: Puccinia
- 2. Occurrence, structure and reproduction of lichens; ecological and economic importance of lichens.

Unit-5: Biology of Bryophytes

- 1. General characteristics of Bryophytes; Rothmaler (1951) classification.
- 2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of
 - (a) Hepaticopsida: Marchantia (b) Anthoceratopsida: Anthoceros
 - (c) Bryopsida: Funaria
- 3. General account on evolution of sporophytes in Bryophyta.

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8Hrs.

8Hrs.

10Hrs.

9Hrs.

10Hrs.

Text Books:

- 1. Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi
- 2. Hait,G., K.Bhattacharya & A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata

Additional Inputs:

Unit I: Single Cell Protein (SCP)

Unit II: Chlamydomonas – Typical algal cell structure

Reference Books:

- 1. Fritsch, F.E. (1945) The Structure□& Reproduction of Algae (Vol. I & Vol. II) Cambridge University Press Cambridge, U.K.
- 2. Bold, H.C.& M. J. Wynne (1984) Introduction to the Algae, Prentice-Hall Inc., New Jersey
- 3. Robert Edward Lee (2008) Phycology. Cambridge University Press, New York
- 4. Van Den Hoek, C., D.G.Mann & H.M.Jahns (1996)Algae : An Introduction to Phycology. Cambridge University Press, New York.
- 5. Alexopoulos, C.J., C.W.Mims & M.Blackwell (2007) Introductory Mycology, Wiley& Sons, Inc., New York
- 6. Mehrotra, R.S.& K. R. Aneja (1990) An Introduction to Mycology. New Age International Publishers, New Delhi.
- 7. Kevin Kavanagh (2005) Fungi; Biology and Applications John Wiley& Sons, Ltd., West Sussex, England.
- 8. John Webster & R. W. S. Weber (2007) Introduction to Fungi, Cambridge University Press, New York.
- 9. Shaw, A.J.& B.Goffinet (2000) Bryophyte Biology .Cambridge University Press, New York.

CO-PO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	1	1	1	2	2	2	1	1
CO 2	2	2	1	1	2	1	2	2	2
CO 3	2	1	2	1	2	1	1	2	1
CO 4	2	1	2	1	2	1	1	1	2
CO 5	2	2	2	1	1	2	2	1	2

CO-PSO Mapping

1	-]	Low,	2- Moderate,	3- High,	'-' No Correlation
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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	1	1	1	2	1
CO 2	1	2	3	1	3	1	2
CO 3	3	2	3	1	2	2	3
CO 4	2	1	1	3	1	1	2
CO 5	2	1	2	3	2	1	1

Suggested activities and evaluation methods:

Unit-1: Activity: Algae specimen collection from any water bodies in their locality, recording the characteristics, identification and classifying them according to Fritsch system.

Evaluation method: Evaluating the presentation or report summarizing findings.

Unit-2: Activity: Microscopic observations and recording distinguishing characters of any six algal forms excluding the genera in the syllabus.

Evaluation method: Conducting a Quiz or an exam/ evaluating the chart or drawings or summarized data on similarities and differences.

Unit-3: Activity: Collection or laboratory culture of fungi and reporting the important features.

Evaluation method: Evaluating the report/conducting JAM/Quiz/Group discussion.

Unit-4: Activity: Microscopic observations and summarizing the salient features of the fungal genera and lichen forms in the syllabus.

Evaluation method: Conducting a Quiz or an exam/ evaluating the chart or drawings or concise data on similarities and differences.

Unit-5: Collection, characterization, identification and classification of any four bryophytes from their native locality or college campus.

Evaluation method: Assessment of observations and documentation accuracy/presentation or report summarizing findings based on a rubric.

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Time:3hrs

Marks :60

SECTION-A

I.	Answer any five of the following	5x4=20
	1. Tetra sporophyte	
	2. Nutrition in fungi	
	3. Heterothalism	
	4. Types of lichens	
	5. Anthoceors Thallus	
	6. Diatoms	
	7. Lateral Conjugation	
	8. Lichen Apothecium	

SECTION-B

Answer all the following Questions 5X8 = 40 Marks II. 9.a) Explain the Thallus organisation in Algae? (or) b) Write an account on Economic Importance of Algae? 10.a) Explain the alternations of Generations in Ectocarpus? (or) b).Explain the culture and cultivation of Chlorella? 11. a). Write an essay on Heterthallism and Parasexuality? (or) b).Give an account on Economic Importance of Fungi? 12.a). Explain life History of Phytophthora? (or) b).Explain various stages of life cycle of Puccinia? 13. a) Write an essay on sporophyte evolution in Bryophytes? (or) b).Describe the structure of Funaria capsule?

Dr.V.S.Krishna Government Degree college (A), Visakhapatnam B.Sc. Honours -BOTANY SEM-II Course -3 Non Vascular plants Question Bank

Short answer Questions (4 Marks)

Unit-1

- 1. Algal pigments
- 2. Algal reserve food materials
- 3. Cell stucture in Algae
- 4. Haplontic life cycle

Unit-2

- 1. Lateral Conjugation
- 2. Diatoms
- 3. Cystocarp
- 4. Tetra sporophyte
- 5. Carposporophyte
- 6. Plurelocular sporangia

Unit-3

- 1. Asexual spores in Fungi
- 2. Ainsworth classification
- 3. Heterothalism $\$
- 4. Nutrition in fungi
- 5. Ecological Importance of fungi

Unit-4

- 1. Zygospore
- 2. Teleutosorous
- 3. Types of lichens
- 4. Lichen Apothecium

Unit -5

- 1. Gemma
- 2. Funaria Archegoniophore
- 3. Funaria Antherediophore
- 4. Classification of Bryophytes
- 5. Anthoceors Thallus

Essay Questions (8 Marks)

Unit-1

- 1. Explain the Thallus organisation in Algae?
- 2. Write an account on Economic Importance of Algae?
- 3. Write an essay on General characters of Algae?

Unit-2

- 1. Describe the life cycle of Ploysipohonia?
- 2. Explain the alternations of Generations in Ectocarpus?
- 3. Explain the culture and cultivation of Chlorella?

Unit-3

- 1. Write an essay onGeneral characters of fungi?
- 2. Write an essay on Heterthalism and Parasexuality?
- 3. Give an account on Economic Importance of fungi?

Unit-4

- 1. Explain life History of Phytophthora?
- 2. Explain various stages of life cycle of Puccinia?
- 3. Explain the life cycle of Rhizopus?
- 4. Write an essay on Penicillium?

Unit -5

- 1. Write an essay on sporophyte evolution in Bryophytes?
- 2. Describe the structure of Funaria capsule?
- 3. Explain external and internal structure of Marchantia thallus?
- 4. Explain the gametophyte and spophytic stages of Anthoceros?

SEMESTER – II, COURSE 3: NON-VASCULAR PLANTS (ALGAE, FUNGI, LICHENS, AND BRYOPHYTES)

Credits -1

I. Laboratory/field exercises:

Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts:

- 1. Algae: Spirogyra, Ectocarpus, Vaucheria and Polysiphonia; a centric and a pennate diatom.
- 2. Demonstration of culture and cultivation of Chlorella
- 3. Identification of some algal products available in local market.
- 4. Fungi: Phytophthora, Rhizopus, Penicillium and Puccinia
- 5. Identification of some fungal products available in the local market.
- 6. Lichens: Crustose, foliose and fruiticose
- 7. Bryophyta: Marchantia, Anthoceros and Funaria.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.	Max. Marks: 50
1. Experiment-1 (Algal mixture)- Identify any 2	2X5=10 M
2. Experiment-2 (Section cutting)	10 M
3. Spotters	$3 \ge 5 = 15 M$
4. Record + Viva-voce	10 + 5 = 15 M

SEMESTER – II, COURSE 4: ORIGIN OF LIFE AND DIVERSITY OF MICROBES

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To get awareness on origin and evolution of life.

2. To understand the diversity of microbial organisms.

3. To get awareness on importance of microbes in nature and agriculture.

Lear	ming Outcomes: On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Illustrate diversity of viruses, multiplication and	Level 1(Knowledge)
		Level 2 (Understanding)
CO 2	Discuss the general characteristics,	Level 2 (Understanding)
	classification and economic importance of	
	special groupsof bacteria.	
CO 3	Explain the structure, nutrition, reproduction and	Level 1 (Knowledge)
	significance of eubacteria.	Level 2 (Understanding)
CO 4	Evaluate the interactions among soil microbes.	Level 3 (Application)
		Level 4 (Analysing)
		Level 5 (Evaluation)
CO 5	Compile the value and applications of microbes	Level 2 (Understanding)
	in agriculture.	Level 3 (Applying)
		Level 4 (Analysing)
SEMESTER - II, COURSE 4: ORIGIN OF LIFE AND DIVERSITY OF MICROBES

Syllabus of Theory:

Unit-1: Origin of life and Viruses

- 1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment.; discovery of microorganisms, Pasteur experiments, germ theory of diseases.
- 2. Five kingdom classification of R.H. Whittaker
- 3. Shape and symmetry of viruses; structure of TMV and Gemini virus.
- 4. Multiplication of TMV; A brief account of prions, viroids and virusoids; Transmission of plant viruses and their control.
- 5. Significance of viruses in vaccine production, bio-pesticides and as cloning vectors.

Unit-2: Special groups of Bacteria

- 1. General characteristics, outline classification and economic importance of following special groups of bacteria:
 - a) Archaebacteria b) Chlamydiae c) Actinomycetes
 - d) Mycoplasma e) Phytoplasma f) Cyanobacteria
- 2. Culture and cultivation of Spirulina

Unit-3: Eubacteria

- 1. Occurrence, distribution and cell structure of eubacteria.
- 2. Classification of Eubacteria based on nutrition.
- 3. Reproduction- Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation, Transduction).
- 4. Economic importance of Eu-bacteria with reference to their role in Agriculture and industry (fermentation and medicine).

Unit-4: Soil microbes – interactions

- 1. Distribution of soil microorganisms in soil.
- 2. Factors influencing the soil microflora Role of microorganisms in soil fertility.
- 3. Interactions among microorganisms, mutualism, comensalism, competition, amensalism, parasitism, predation.
- 4. Microorganisms of rhizosphere, phyllosphere and spermophere; microbial interactions and their effect on plant growth.

8 Hrs.

10Hrs.

7 Hrs.

10 Hrs.

Unit-5: Microbes in agriculture

10 Hrs.

1. Mass production, mode of applications, advantages and limitations of bacterial inoculants (*Rhizobium, Azotobacter, Azospirillum*, Cyanobacteria).

- 2. Role of Frankia and Arbascular Mycorhizae in soil fertility.
- 3. Microbial biopesticides: mode of action, factors influencing, target pests; microbial herbicides.

Additional Inputs:

Unit I: Origin of Corona Virus and Role of AM in Soil Fertility

Deleted: Phytoplasma

Text Books:

- 4. Bhattacharjee, R.N., (2017) Introduction to Microbiology and Microbial Diversity, Kalyani Publishers, New Delhi.
- 5. Dubey, R.C. & D. K. Maheswari (2013) A Text Book of Microbiology, S.Chand & Company Ltd., New Delhi
- 6. Toshniwal, R.L. (2007) Agricultural Microbiology, Agrobios (India), Jodhpur

Reference Books:

- Pelczar Jr., M.J., E.C.N. Chan & N. R. Krieg (2001) Microbiology, Tata McGraw-Hill Co, New Delhi
- 8. Presscott, L. Harley, J. and Klein, D. (2005) Microbiology, Tata McGraw –Hill Co. New Delhi.
- 9. Gyaneshwar, A.D., G.J. Parekh, and V.S. Reddy (2004) Agricultural Microbiology: Plant-Soil Interactions, Research Signpost, Kerala, India
- 10. Zaki A. Shuler and Zainul Abid (2014) Agricultural Microbiology: Principles and Applications, CRC Press, Boca Raton, Florida, USA

CO-PO Mapping

2- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	1	-	-	-	-	-	1	1	3
CO 2	1	-	-	-	-	-	2	2	3
CO 3	1	-	-	-	-	-	-	-	3
CO 4	2	-	-	-	-	2	2	2	3
CO 5	1	-	-	-	-	2	3	3	3

CO-PSO Mapping

2- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	1	1	1	1	1	2
CO 2	2	1	2	1	1	1	1
CO 3	2	1	1	1	1	1	1
CO 4	2	1	2	1	1	1	2
CO 5	2	1	1	1	1	2	2

II. Suggested activities and evaluation methods:

Unit-1: Activity: Collecting scientific literature on historical developments in microbiology.

Evaluation method: Evaluating the report based on a rubric.

Unit-2: Activity: Group discussion on various groups of special bacteria.

Evaluation method: Assessment of active participation, soft skills, communication skills, collaborative skills, time management etc., of a group or a student based on a rubric.

Unit-3: Activity: Presentation or poster summarizing the classification of Eu-bacteria based on nutrition.

Evaluation method: Assessment based on accuracy and understanding.

Unit-4: Activity: Microscopic observation of bacterial samples from soil/ phylloplane in their native place/ college campus.

Evaluation method: Evaluating the report on characteristics and classification of eubacteria.

Unit-5: Activity: Culture and mass production of bioinoculants.

Evaluation method: Skills performed in establishing the culture and mass production.

Dr.V.S.Krishna Government Degree college (A), Visakhapatnam B.Sc. Honours -BOTANY SEM-II,Course – 4: Origin of life and Diversity of Microbes Model question paper

Time:3hrs

Marks :60

SECTION-A

I.	Answer any five of the following	5x4=20
	1. Germplasm theory	
	2. Cloning vectors	
	3. Nutrition in Bacteria	
	4. Microbial herbicides	
	5. Parasitism	
	6. Rhizobium	
	7. TMV	
	8 Azospirllum	

SECTION- B

Answer all the following Questions

5x8=40

9.a) Describe the concept of Abiogenesis and Miller and Urey experiment? (or)

b) Explain the transmission of plant viruses and their control methods?

10.a) Give an account of Archebacteria and mention their Ecological significance? (or)

b). Give an account on culture and cultivation of spirulina?

11. a). Describe the cell structure of Bacteria?

(or)

b). Give an account on Economic Importance of Bacteria?

12.a). Describe the role of Microorganisms in soil fertility?

(or)

b). Give an account on Microbial Interactions and their effects on plant growth?

13. a) Explain the applications ,advantages and limitations of bacterial inoculation ? (or)

b). Write an essay on VAM & Frankia?

Dr.V.S.Krishna Government Degree college (A), Visakhapatnam

B.Sc. Honours -BOTANY

Course -4 Origin of life and Diverisity of Microbes

Question Bank

Short Questions (4 Marks)

Unit-1

- 1. Germ plasm theory
- 2. TMV
- 3. Cloning vectors
- 4. Viroids &virosoids

Unit-2

- 1. Archaebacteria
- 2. Cyano bacteria
- 3. Actinomycetes
- 4. Mycoplasma

Unit-3

- 1. Transduction
- 2. Nutrition in Bacteria
- 3. Bacterial conjugation
- 4. Transformation

Unit-4

- 1. Parasitism
- 2. Commensalism
- 3. Soil Microflora
- 4. Distribution of soil micro organisms

Unit-5

- 1. Azatobacter
- 2. Microbial herbicides
- 3. Rhizobium
- 4. Azospirillum

Essay Questions (8 Marks)

Unit -1

- 1. Describe the concept of Abiogenesis and Miller and Urey experiment?
- 2. Explain the transmission of plant viruses and their control methods?
- 3. Give a detailed account on five kingdom classification of R.H.Whittaker?

Unit-2

- 4. Write an essay on Actinomycetes?
- 5. Give an account of Archebacteria and Mention their Ecological significance?
- 6. Give an account on culture and cultivation of spirulina

Unit-3

- 7. Describe the cell structure of Bacteria?
- 8. Describe the process of sexual reproductive methods in Bacteria?
- 9. Give an account on Economic Importance of Bacteria?

Unit-4

10. Describe the role of micr organisms in soil fertility?

- 11. Give an account on microbial Interactions and their effects on plant growth?
- 12. Write an essay on Inter actions among Microorganisms?

Unit-5

- 13. Explain the applications , advantages and limitations of bacterial inoculation ?
- 14. Write an essay on VAM & Frankia?
- 15. Write an essay on Microbial bio –pesticides?

SEMESTER – II, COURSE 4: ORIGIN OF LIFE AND DIVERSITY OF MICROBES Credits -1

I. Laboratory/Field exercises:

- 1. Microbiology good laboratory practices and bio safety.
- 2. Study the principle and applications of important instruments (autoclave, hot air oven, incubator, Inoculation loop, Inoculation needle, membrane filter, laminar air flow system, colony counter. biological safety cabinets, BOD incubator, pH meter) used in the microbiology laboratory.
- 3. Study of Viruses (Gemini and TMV) using electron micrographs/ models.
- 4. Gram staining technique of Bacteria.
- 5. Microscopic study of Cyanobacteria using temporary/permanent slides.
- 6. Microscopic study of Eubacteria using temporary/permanent slides.
- 7.Study of Archaebacteria and Actinomycetes using permanent slides/ electron micrographs/diagrams.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.	Max. Marks: 50
1.Experiment-1 (Major Experiment) Gram Staining	15 M
2.Soptters (Instrument + Micrographs)	5X4 = 20 M
3.Record + Viva-voce	10 + 5 = 15 M

SEMESTER – III, COURSE 5 : VASCULAR PLANTS

(Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To recognize the morphology, anatomy and reproduction in two groups of archegoniates.
- 2. To acquire knowledge of the taxonomic aids and classification systems.
- 3. To read the vegetative and floral characteristics of some forms of angiospermic families along with their economic value.
- 4. To study the significance of other branches of botany in relation to plant taxonomy.

II. Learning Outcomes: On completion of this course students will be able to:

On	Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.	Level 1(Knowledge)
CO 2	Illustrate the general characteristics of Gymnosperms along with their uses	Level 1(Knowledge) Level 2 (Understanding)
CO 3	Discuss about some Taxonomic aids and their applications in plant systematics.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Compare and contrast the vegetative and floral characteristics of some angiospermic families.	Level 3 (Application) Level 4 (Analysing)
CO 5	Evaluate the economic value of plant species from the families under the study.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO6	Defend the utility of evidences from different branches of botany in solving the taxonomic lineages of some species.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER – III, COURSE 5 : VASCULAR PLANTS (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

III. Syllabus of Theory: Unit-1: Pteridophytes

- 1. General characteristics of Pteridophyta; Smith (1955) classification.
- 2. Occurrence, morphology, anatomy, reproduction (developmental details are notneeded) and life history of: (a) Lycopsida: Lycopodium and (b) Filicopsida: Marsilea
- 3. Stelar evolution in Pteridophytes; Heterospory and seed habit.
- 4. Ecological and economic importance of Pteridophytes.

Unit-2: Gymnosperms

- 1. General characteristics of Gymnosperms; Sporne (1965) classification.
- 2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed)

and life history of:(a) Cycadopsida: Cycas and (b) Gnetopsida: Gnetum

3. Ecological and economic importance of Gymnosperms.

Unit-3: Principles of Plant Taxonomy

- 1. Aim and scope of taxonomy, species concept, taxonomic hierarchy-major and minor categories.
- 2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
- 3. Herbarium and its techniques, BSI herbarium and Kew herbarium; concept of digital herbaria.
- 4. Bentham and Hooker system of classification.
- 5. Phylogenetic systematics: primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly, clades. synapomorphy, symplesiomorphy, apomorphy. APG-IV classification.

Unit-4: Descriptive Plant Taxonomy

Systematic description and economic importance of the following families:

- 1. Polypetalae: (a) Annonaceae (b) Curcurbitaceae
- 2. Gamopetalae: (a) Asteraceae (b) Asclepiadaceae
- 3. Monochlamydae: (a) Amaranthaceae (b) Euphorbiaceae
- 4. Monocotyledonae: (a) Arecaceae (b) Poaceae **Unit-5: Evidences for Plant systematics**
- 1. Anatomy and embryology in relation to plant systematics.
- 2. Cytology and cytogenetics in relation to plant systematics.
- 3. Phytochemistry in relation to plant systematics.
- 4. Numerical taxonomy
- 5. Origin and evolution of angiosperms.
- t

10Hrs.

10Hrs.

10 Hrs.

8 Hrs.

7Hrs.

Additional Inputs:

Unit III: ICN rules for Nomenclature and Herbaria of World

IV. Text Books:

- 1. Acharya, B.C., (2019) Archchegoniates, Kalyani Publishers, New Delhi
- 2. Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) A Text Book of Botany, VolumeII, New Central Book Agency Pvt. Ltd., Kolkata
- 3. Hait,G., K.Bhattacharya&A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
- 4. Pandey, B.P. (2013) College Botany, Volumes-I&II, S. Chand Publishing, New Delhi

V. Reference Books:

- 1. Smith, G.M. (1971) CryptogamicBotanyVol. II., Tata McGraw Hill, New Delhi
- 2. Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi
- 3. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
- 4. Coulter, J.M. & C.J.Chamberlain(1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
- 5. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi
- Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K .InternationalPvt. Ltd., New Delhi
- 7. Singh, G. (2012). Plant Systematics: Theory and Practice.Oxford& IBH Pvt.Ltd., NewDelhi.
- Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA,U.S.A.

CO-PO Mapping

3-	Low,	2- Moderate,	3- High,	'-' No	Correlation
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2	-	-	-	1	-	-	2
CO 2	1	1	-	-	-	2	-	-	1
CO 3	2	3	2	1	1	3	-	-	2
CO 4	2	2	1	-	-	2	-	-	1
CO 5	1	1	2	1	-	2	1	-	1
CO 6	2	1	-	-	-	1	-	-	2

CO-PSO Mapping

3- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	1	1	1	1	1
CO 2	1	1	1	1	1	1	1
CO 3	1	2	1	1	1	1	1
CO 4	1	1	1	1	1	2	1
CO 5	1	1	1	1	1	2	1
CO 6	2	1	1	1	1	1	1

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Making temporary slides/models/drawings of Pteridophytes in the syllabus. **Evaluation method:** Assessment of the temporary slides/model/drawing.

Unit-2: Activity: Study of wood elements in locally available Gymnosperms and making temporary slides.

Evaluation method: Validation of prepared slides submitted by the learner.

Unit-3: Activity: Botanical field trip and collecting plant specimens for herbarium.

Evaluation method: Attendance in field trip and submission of field note book and herbarium sheets with filled in labels.

Unit-4: Activity: Making good models or drawings or collection of photographs of some important plant species from the families included in the syllabus.

Evaluation method: Authorize the quality of the work and conferring reward.

Unit-5: Activity: Collection of scientific literature on solving taxonomic problems by taking evidences from other branches of Botany.

Evaluation method: Validation of the collection submitted along with summary.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester –III : Course-5 Theory Paper (w.e.f. 2023-2024)

Paper-5: Vascular Plants (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any $\ensuremath{\textbf{FIVE}}$ of the following questions, Draw neat and labeled diagrams wherever necessary

- 1. Binomial Nomenclature
- 2. Marsilea Sporocarp
- 3. Cycas megasporophyll
- 4. Translator mechanism
- 5. Numerical Taxonomy
- 6. Economic importance of Cucurbitaceae
- 7. Heterospory
- 8. Floral characters of Euphorbiaceae

Section – B

5×8= 40 MARKS

Answer all Questions, Draw neat and labelled diagrams wherever necessary

1. a). Describe the general characteristics of Pteridophytes?

(OR)

b) Write an essay on Stelar evolution in Pteridophytes.

2. a) Explain reproduction in Gnetum?

(OR)

b) Write an essay on economic importance of Gymnosperms?

3. a) Write an essay on herbarium technique?

(OR)

b) Describe the Bentham and Hookers system of classification?

4. a) Describe the floral characters of Asteraceae?

(OR)

b) Explain the floral characters of family Annonaceae in technical terms?

5. a) Explain the phytochemistry in relation to plant systematic?

(OR)

b) Describe Cytology and Cytogenetics in relation to plant systematic?

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Paper-5: Vascular Plants (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Question Bank

Short Answer Questions (4 Marks)

Unit – 1: Pteridophytes

1. Classification of Pteridophytes

2. Marsilea Sporocarp

3. Economic importance of Pteridophytes

Unit – 2: Gymnosperms

Classification of Gymnosperms
 Cycas Megasporophyll
 Gnetum Female Flower
 Unit – 3: Gymnosperms

Binomial Nomenclature
 ICBN
 BSI
 Digital Herbarium
 APG-IV Classification
 Homology and Analogy
 Monophyly, Paraphyly, Polyphyly
 Unit – 4: Descriptive Plant Taxonomy

Economic importance of Annonaceae
 Nature of tendril in Cucuritaceae
 Economic importance of Cucurbitaceae
 Floral characters of Asteraceaae
 Translator Mechanism
 Floral Characters of Amaranthaceae
 Floral characters of Euphorbiaceae
 Economic importance of Euphorbiceae
 Floral Characters of Arecaceae
 Economic importance of Poaceae

Unit – 5: Evidences for Plant systematics

1.Phytochemistry in relation to plant systematics2.Numerical Taxonomy

Essay Questions (8 Marks)

Unit – 1: Pteridophytes

- 1. Explain the General characters of Pteridophytes?
- 2. Write an essay on Stelar evolution in Pteridophytes?
- 3. Write an essay on *Marsilea* sexual reproduction?
- 4. Write an essay on *Lycopodium* sexal reproduction?

Unit – 2: Gymnosperms

- 5. Explain the General characters of Gymnosperms?
- 6. Write an essay on anatomy of *Cycas* leaf?
- 7. Explain the sexual reproduction in *Gnetum*?

Unit – 3: Principles of Plant Taxonomy

- 8. Write an essay on Herbarium?
- 9. Explain the Benthom and Hooker's System of classification and mention the merits and demerits of it?

Unit – 4: Descriptive Plant Taxonomy

- 10. Describe the floral characters of family Annonaceae?
- 11. Describe the floral characters of family Cucurbitaceae?
- 12. Describe the floral characters of family Asteraceae?
- 13. Describe the floral characters of family Asclepiadaceae?
- 14. Describe the floral characters of family Amaranthaceae?
- 15. Describe the floral characters of family Euphorbiaceae?
- 16. Describe the floral characters of family Arecaceae?
- 17. Describe the floral characters of family Poaceae?

Unit – 5: Evidences for Plant systematics

- 18. Describe the origin and evolution of Angiosperms in detail?
- 19. Cytology and cytogenetics in relation to plant systematics?

Semester – III, Course 5 : Vascular Plants (Pteridophytes, Gymnosperms and Angiosperm Taxonomy)

Practical

02 hours /Week

II Laboratory/field exercises:

I. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/specimens/ mounts:

- 1. Pteridophyta: Lycopodium and Marselia
- 2. Gymnosperms: Cycas and Gnetum
- II. Technical description of locally available plant species from the following angiosperm families:
- 1. Annonacae
- 2. Cucurbitaceae
- 3. Asteraceae
- 4. Asclepiadaceae
- 5. Amaranthaceae
- 6. Euphorbiaceae
- 7. Arecaceae
- 8. Poaceae
- III. Demonstration of herbarium techniques.
- IV. Field trip to a local floristic area/forest (Submission of 30 number of Herbarium sheets of wild plants with the standard system are mandatory).

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

5 M

- Experiment-1 (Section cutting A)
 Experiment-2 (Section cutting B)
 Technical description(Taxonomy)
 Herbarium Technique (Procedure)
 5 M
- 5. Herbarium
- 6. Record + Viva-voce 7 + 3 = 10 M

SEMESTER – III, COURSE 6: PLANT PATHOLOGY AND PLANT DISEASES

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To study various plant pathogens, their survival and dispersal mechanisms.

2. To understand the processes involved in infection and pathogenesis in plants.

3. To study the common diseases of some important field and horticultural crops.

II. Learning Outcomes:

On Cor	npletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Identify major groups of plant pathogens and classify plant diseases.	Level (Knowledge)
CO 2	Explain various stages in infection, plant pathogenesis and responsible factors.	Level 2 (Understanding)
CO 3	Elaborate the preventive and control measures for plant diseases.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Discuss about some diseases of field crops and their management.	Level 3 (Application) Level 4 (Analysing)
CO 5	Discuss about some diseases of horticultural crops and their management.	Level 2 (Understanding) Level 3 (Applying)
		Level 4 (Analysing)

SEMESTER – III, COURSE 6: PLANT PATHOLOGY AND PLANT DISEASES

Credits -3 **III Syllabus of Theory**

Unit-1: Plant pathogens, survival and dispersal

- 1. Plant pathology: definition, importance of plant diseases, important famines in world; scope and objectives of plant pathology.
- 2. Important plant pathogenic organisms with examples of diseases caused by them.
- 3. Classification of plant diseases based on important criteria.
- 4. A brief account on survival of plant pathogens.
- 5. Dispersal of plant pathogens active and passive processes.

Unit-2: Infection and pathogenesis in plants

- 1. Infection process pre-penetration, penetration and post-penetration.
- 2. Role of enzymes in plant pathogenesis.
- 3. Role of toxins in plant pathogenesis.
- 4. Role of growth regulators in plant pathogenesis.
- 5. Defense mechanisms in plants against pathogens.

Unit-3: Plant disease management

- 1. Plant disease epidemiology; plant disease forecasting; remote sensing in plant pathology.
- 2. General principles of plant diseases management.
- 3. Regulatory methods, cultural methods; biological control and PGPR.
- 4. Physical methods, chemical methods; host plant resistance.
- 5. Integrated plant disease management (IDM) Concept, advantages and importance.

Unit-4: Diseases of field crops

Symptoms, etiology, disease cycle and management of major diseases of following crops:

- a) Rice: Blast of rice, bacterial blight and Tungro
- b) Bajra: Downy mildew and Ergot
- c) Pigeon-pea: Phytophthora blight, wilt and sterility mosaic
- d) Groundnut: Tikka leaf spot, rust and root rot

Unit-5: Diseases of horticultural crops

Symptoms, etiology, disease cycle and management of major diseases of following crops:

- a) Brinjal: Phomopsis blight and Little leaf
- b) Okra: Powdery mildew and Yellow vein mosaic
- c) Pomegranate: Alternaria fruit spot and Anthracnose

12 Hrs.

9 Hrs.

8 Hrs.

8 Hrs.

8 Hrs.

d) Coconut: Bud rot and Basal stem rot

Additional Inputs: Nil

Deleted: Tungro Root Rot

III. Text Books:

- 1. P.D. Sharma (2011) Fundamentals of Plant Pathology, Tata McGraw-Hill Education, New Delhi
- 2. R.S. Singh and U.S. Singh (2017) Plant Pathology: An Introduction, CRC Press, Boca Raton, Florida, USA
- 3. R.S. Mehrotra (2008) Plant Pathology, Tata McGraw-Hill Education, New Delhi
- 4. M. S. Reddy and Gopal Singh (2016) Plant Pathology: Concepts and Laboratory Exercises, Scientific Publishers, Jodhpur, India

IV. Reference Books:

- 1. Agrios, G. N. (2005). Plant Pathology (5th ed.). Academic Press, San Diego, California.
- 2. Dehne, H. W. (Ed.). (2012). Plant Pathology: From Molecular Biology to Biological Control. Springer, Dordrecht, Netherlands.
- 3. Dicklow, M. B., & Beaudry, R. M. (Eds.). (2013). Plant Pathology Concepts and Laboratory Exercises (2nd ed.). CRC Press, Boca Raton, Florida.
- 4. Lucas, J. A. (1998). Plant Pathology and Plant Pathogens. Blackwell Science, Oxford, UK.
- 5. Lucas, J. A. (1998). Plant pathology and plant pathogens. Blackwell Science, Oxford, UK.
- 6. Schumann, G. L., & D'Arcy, C. J. (2010). Essential Plant Pathology (2nd ed.). APS Press, St. Paul, Minnesota.
- 7. Schumann, G. L., and C. D'Arcy (2010). Essential plant pathology. APS Press, St. Paul, MN.
- 8. Singh, R. P., and U. S. Singh (2020). Plant diseases: Identification, management and challenges. Springer, Singapore.

CO-PO Mapping

4- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	1	2	-	1	-	2	-	-	2
CO 2	1	1	-	1	-	1	-	-	1
CO 3	2	1	1	1	-	2	-	-	2
CO 4	3	2	1	1	-	1	-	-	2
CO 5	3	3	1	1	-	1	-	-	2

CO-PSO Mapping

4- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	1	1	1	1	1	1
CO 2	1	1	1	1	1	1	1
CO 3	1	1	1	1	1	1	1
CO 4	1	1	1	1	1	1	1
CO 5	1	1	1	1	1	1	1

V. Suggested activities and evaluation methods:

Unit-1: Activity: Field Survey and making a report on various plant pathogens, their survival and dispersal mechanisms.

Evaluation method: Field reports, presentations and visual documentation based on a rubric. **Unit-2: Activity:** Case studies on plant infections and factors contributing to disease development.

Evaluation method: Diagnostic evaluation of case study report for problem-solving and critical thinking skills.

Unit-3: Activity: A survey report on various preventive and control measures for plant diseases practiced by the farmers in their locality.

Evaluation method: Peer review by students on the quality of report.

Unit-4: Activity: Field survey and data collection on diseases of local field crops.

Evaluation method: Assessment of the quality of report bases on a rubric.

Unit-5: Activity: Microscopic observations and making drawings of diseased samples. Evaluation method: Formative assessment of presentation of findings through visuals/ drawings.

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Paper-6: Plant Pathology and Plant Diseases

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labeled diagrams wherever necessary

- 1. Active dispersal process of plant pathogens.
- 2. Passive dispersal process of plant pathogens.
- 3. PGPR
- 4. Biological control of PGPR
- 5. Sterility mosaic
- 6. Rice Tungro
- 7. Yellow vein mosaic
- 8. Ergot of bajra

Section – B

5×8= 40 MARKS

Answer any **Five** of the following Questions, Draw neat and labeled diagrams wherever necessary 1. a. Write an essay on active processes of dispersal of plant pathogens.

(OR)

b. Write a brief account on survival of pathogens.

2. a. Write an essay on role of enzymes in plant pathogens.

(OR)

b. Describe the defense mechanisms in plants against pathogens.

3. a. Write an essay General principles of plant diseases management.

(OR)

b. Describe physical methods, chemical methods of host plant resistance.

4. a. Describe the disease cycle of Blast of rice.

(OR)

b. Write an essay on symptoms, disease cycle and control measures of Tikka disease of groundnut.

5 a. Desribe the disease cycle of Powdery mildew of Okra.

(OR)

b. Write an essay on disease cycle of little leaf of brinjal.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester –III: Course-6 Theory Paper (w.e.f. 2023-2024) Paper-6: Plant Pathology and Plant Diseases

Question Bank

Short Answer Questions (4 Marks)

Unit – 1: Plant pathogens, survival and dispersal

1. Active and passive process of Dispersal of plant pathogens.

2. Scope and objectives of plant pathology.

Unit - 2: Infection and pathogenesis in plants

- 1. Role of growth regulators in plant pathogenesis.
- 2. Role of toxins in plant pathogenesis.

3. PGPR

Unit – 3: Plant disease management

4. Integrated plant disease management (IDM)

Unit – 4: Diseases of field crops

- 5. Blast of rice
- 6. Rice Tungro
- 7. Downy mildew
- 8. Phytophthora blight
- 9. Root rot of groundnut
- 10. Tikka disease

Unit – 5: Diseases of horticultural crops

- 11. Little leaf of brinjal
- 12. Yellow vein mosaic of okra
- 13. Basal stem rot of coconut

Essay Questions (8 Marks)

Unit – 1: Plant pathogens, survival and dispersal

1. Write a brief account on survival of plant pathogens.

- 2. Active and passive processes of dispersal of plant pathogens
- 3. Write a brief account on survival of plant pathogens.

Unit - 2: Infection and pathogenesis in plants

3. Describe the pre-penetration, penetration and post-penetration processes of infection.

4. Write an essay on defense mechanisms in plants against pathogens.

5. Give a detailed account on role of growth regulators in plant pathogenesis.

6. Give a detailed account on role of Enzymes in plant pathogenesis.

7. Give a detailed account on role of toxins in plant pathogenesis.

Unit – 3: Plant disease management

8. Write an essay on general principles of plant diseases management.

9. Desribe various physical and chemical methods of host plant resistance.

10. Write an essay on Integrated plant disease management (IDM)

Unit – 4: Diseases of field crops

11. Write an essay on disease cycle of blast of rice.

12. Write an essay on disease cycle of Ergot of bajra.

13. Describe the symptoms, control measures and disease cycle of Tikka disease of groundnut.

Unit – 5: Diseases of horticultural crops

- 14. Desribe the disease cycle of Little leaf of brinjal.
- 15. Desribe the disease cycle of Powdery mildew of okra.
- 16. Desribe the disease cycle of Alternaria fruit spot of pomegranate.

SEMESTER – III, COURSE 6: PLANT PATHOLOGY AND PLANT DISEASES

Credits -1

I. Laboratory/field exercises:

- 1. Familiarity with general plant pathological laboratory and field equipment.
- 2. Isolation and Identification of plant pathogenic fungi.
- 3. Isolation and Identification of plant pathogenic bacteria.
- 4. Identification of phanerogamic plant parasites.
- 5. Isolation and Identification of plant pathogenic nematodes.
- 6. Demonstration of Koch's postulates
- 7. Identification and histopathological studies of selected diseases of field crops.
- 8. Identification and histopathological studies of selected diseases of horticultural crops.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

05 M

- 1. Experiment-1 (Study of Blast of Rice) 10 M
- 2. Experiment-2 (Study of Tikka disease) 10 M
- 3. Experiment-3 (Study of Downy Mildew) 10 M
- 4. Koch Postulates
- 5. Record + Viva-voce 10 + 5 = 15 M

III SEMESTER, COURSE 7: PLANT BREEDING

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To learn the objectives and scope of plant breeding along with reproductive methods in plants.
- 2. To understand the breeding methods in plant for production of new varieties.
- 3. To have a comprehensive knowledge on tools and techniques in plant breeding.
- **II.** Learning Outcomes:

On C	Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Compare and contrast the methods of reproduction and also pollination mechanisms.	Level 1(Knowledge)
CO 2	Design appropriate pollination method for a given crop plant.	Level 2 (Understanding)
CO 3	Recommend the best possible breeding method for a crop species.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Propose the steps for production of hybrid varieties of crop plants.	Level 3 (Application) Level 4 (Analysing)
CO 5	Apply molecular techniques to develop a tailored plant variety.	Level 2 (Understanding) Level 3 (Applying)
		Level 4 (Analysing)

III SEMESTER, COURSE 7: PLANT BREEDING

Syllabus of Theory

Unit-1: Basic concepts of plant breeding

1. Definition, aim, objectives and scope of plant breeding; concepts in plant breeding: genetic variation, heritability, and selection.

- 2. Advantages and disadvantages of asexual and sexual reproduction; apomixis: definition, types and significance.
- 3. A brief account of self and cross-pollination, their genetic consequences and significance; classification of crop plants based on mode of pollination and mode of reproduction.

Unit-2: Contrivances for cross pollination

- 1. Self-incompatibility in plants Definition, heteromorphic and homomorphic systems; exploitation of self-incompatibility in hybrid production.
- 2. Male sterility- Genetic, cytoplasmic and cytoplasmic-genetic, utilization in plant breeding.
- 3. Domestication of plants, centres of origin of crop plants.

Unit-3: Breeding methods in plants

- 1. Plant introduction types, objectives, plant introduction agencies in India, procedure, merits and demerits; germplasm collections, genetic erosion, gene sanctuaries.
- 2. Selection natural and artificial selection basic principles of selection.
- 3. Self-pollinated crops: pure line selection method procedure, advantages and disadvantages, achievements.
- 4. Vegetatively propagated crops: Clonal selection procedure, advantages and disadvantages, achievements.

12 Hrs. **Unit-4: Breeding methods in cross-pollinated plants**

- 1. Hybridization objectives, types, procedure, advantages and disadvantages, achievements.
- 2. Cross-pollinated crops: back cross method procedure, advantages and disadvantages, achievements.
- 3. Heterosis: definition, genetic bases of heterosis dominance, over dominance and epistasis hypotheses; physiological bases of heterosis – commercial utilization.
- 4. Synthetics and composites production procedures merits, demerits and achievements.

9 Hrs.

7 Hrs.

8 Hrs.

Unit-5: Modern methods in plant breeding

9 Hrs.

- 1. Mutation breeding: spontaneous and induced mutations characteristic features of mutations procedure of mutation breeding applications advantages, limitations and achievements.
 - 2. Polyploidy breeding: auto-polyploids and allopolyploids applications in crop improvement and limitations.
 - 3. DNA markers and their applications in plant breeding: RFLP, SSR, and SNP
 - 4. Marker Assisted Selection (MAS) and its applications in plant breeding.

Additional Inputs:

Unit V: RAPD

Deleted: SNP

III. Text Books:

- 1. Singh, B. D. (2001) Plant breeding: Principles and methods. Kalyani Publishers, New Delhi, India.
- 2. Poehlman, J. M. and Sleper, D. A. (1995) Breeding field crops, 4th ed. Iowa State University Press, Ames, Iowa, USA.
- 3. Patil, J.V., S.S. Patil, and R.A. Balikai (2019) Principles and Methods in Plant Breeding, Scientific Publishers (India), Jodhpur
- 4. Purohit, S.S. (2014) Plant Breeding: Principles and Methods, Agrobios (India), Jodhpur

IV. Reference Books:

- 1. Acquaah, G. 2012. Principles of plant genetics and breeding, 2nd ed. Wiley-Blackwell, Ames, Iowa, USA.
- 2. Allard, R. W. 1999. Principles of plant breeding. John Wiley & Sons, New York, USA.
- 3. Stuber, C. W., Edwards, M. D. and Wendel, J. F. 1987. Molecular markers in plant breeding: Applications and potential. Science 238: 1659-1664.
- 4. Hayes, H. K., R. E. Kirk, and R. H. Jones (1951). Methods for the Statistical Analysis of Plant Breeding Experiments. Iowa State College Press, Ames, IA.
- 5. Simmonds, N. W. (1979). Principles of Crop Improvement (2nd ed.). Longman, Harlow, UK

CO-PO Mapping

5- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2	-	-	-	2	-	-	1
CO 2	2	1	-	-	-	2	-	-	2
CO 3	2	1	-	-	-	2	-	-	2
CO 4	3	2	1	2	-	1	-	-	1
CO 5	1	-	-	1	-	1	-	-	2

CO-PSO Mapping

5- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2	3	2	1	1	1	2
CO 2	1	2	2	1	1	1	2
CO 3	2	2	2	1	1	1	2
CO 4	1	2	2	2	1	1	2
CO 5	1	2	2	2	1	1	2

V. Suggested activities and evaluation methods:

Unit-1: Activity: Written assessment on reproduction and pollination mechanisms in plants. **Evaluation method:** Awarding grade based on writing appropriate points in a descriptive way. **Unit-2: Activity:** Collection of scientific literature on contrivances in plants to promote cross fertilization.

Evaluation method: Quality and organization of the report in a systematic way with data collected and analysis made.

Unit-3: Activity: Hands on activity of selection procedure for a given crop plant.

Evaluation method: Assessment of understanding and applying appropriate selection procedure. **Unit-4: Activity:** Field trip to an agriculture or a horticulture research station to learn hybridization techniques.

Evaluation method: Active participation and learning skills on production of hybrid plants. **Unit-5: Activity:** Case studies of modern applications of molecular techniques in crop improvement.

Evaluation method: Based on a rubric with specified criteria and performance levels of the learner.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM II B.Sc. (Botany) Major - Semester –III : Course-7 Theory Paper (w.e.f. 2023-2024) Paper-7: PLANT BREEDING

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 1. Objectives of Plant Breeding.
- 2. Apomixis.
- 3. Cytoplasmic male sterility.
- 4. Domestication of plants.
- 5. Clonal Selection.
- 6. Types of Hybridization.
- 7. Heterosis.
- 8. RFLP

Section – B

5×8= 40 MARKS

Answer any FIVE of the following Questions, Draw neat and labelled diagrams wherever necessary

1. a) Compare advantages and disadvantages of sexual reproduction with that of asexual reproduction?

or

- b) Give a brief account of cross pollination and add a note on its significance?
- 2. a) Explain self incompatibility in plants?

Or

b) Describe centres of origin of crop plants?

3. a) Describe the Plant introduction method in detail?

Or

b) Describe in detail about Pureline selection?

4. a) Describe the procedure of Hybridization?

or

b) Explain the production procedures of Synthetics and Composites?

5. a) Write an essay on Polyploidy breeding?

Or

b) Describe Marker Assisted Selection and its applications in Plant breeding?

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Question Bank

Short Questions (4 Marks)

Unit – 1: Basic concepts of Plant breeding

- 1. Objectives of Plant breeding.
- 2. Genetic variation.
- 3. Heritability.
- 4. Selection.
- 5. Asexual reproduction.
- 6. Apomixis.
- 7. Self pollination

Unit – 2: Contrivances for cross pollination

8.Cytoplasmic male sterility.

9. Domestication of plants.

10. Homomorphicself incompatibility.

Unit – 3: Breeding methods in plants

- 11. Germplasm collection.
- 12. Genetic erosion.
- 13. Gene sanctuaries.
- 14. Clonal selection.

Unit - 4: Breeding methods in cross pollinated plants

- 15. Types of hybridization.
- 16. Achievements of hybridization.
- 17. Emasculation.
- 18. Back cross method.
- 19. Heterosis.

Unit – 5: Modern methods in Plant breeding

20. Mutagens.

- 21. Autopolyploids.
- 22. SSR.
- 23. SNP.

Essay Questions (8 Marks)

Unit - 1:Basic concepts of Plant breeding

- 1. Describe advantages and disadvantages of sexual reproduction?
- 2. Give a brief account of cross pollination, its genetic consequence and significance?
- 3. Describe classification of plants based on mode of pollination and reproduction?

Unit – 2: Contrivances for cross pollination

- 4. Describe self incompatibility in plants?
- 5. Explain utilization of male sterility in plant breeding?
- 6. Describe centres of origin of crop plants?

Unit – 3: Breeding methods in plants

- 7. Write an essay on Plant introduction?
- 8. Describe the method of pure line selection, its merits, demerits and achievements?

Unit – 4: Breeding methods in cross pollinated plants

- 9. Describe the procedure of hybridization?
- 10. Explain genetic basis of heterosis?
- 11. Describe production procedure of synthetics and composites?

Unit – 5: Modern methods in Plant breeding

- 12. Write an essay on mutation breeding?
- 13. Describe polyploidy breeding?
- 14. Describe Marker Assisted Selection and its application in plant breeding?

III Semester Course 7: Plant Breeding

Credits -1

I. Laboratory/field exercises:

- 1. Floral biology in a self and a cross pollinated plant species.
- 2. Identification and classification of plants based on pollination mechanism.
- 3. Pollen viability test.
- 4. Observation on pollen germination.
- 5. Practicing emasculation technique.
- 6. Practicing selfing and crossing techniques.
- 7. Assessment of genetic variability.
- 8. Estimation of heterosis and inbreeding depression.
- 9. Studying mutant and polyploids in crop plants.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

- 1. Experiment-1 (Pollen germination test)10 M
- 2. Experiment-2 (Pollen viability test) 10 M
- 3. Pollination Mechanism 5 M
- 4. Hybridization outline 5 M 5 M
 - 5. RFLP
- 6. Record + Viva-voce 10 + 5 = 15 M

III SEMESTER, COURSE 8: PLANT BIOTECHNOLOGY

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To acquire knowledge of sterilization techniques used in plant tissue culture.

- 2. To learn about various types of plant tissue culture practices.
- 3. To know the applications of plant biotechnology in production of novel plants.
- **II. Learning Outcomes:** Students at the successful completion of the course will be able to:

On Co	ompletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Explain the scientific techniques and tools used in plant tissue culture laboratories.	Level 1(Knowledge)
CO 2	Appraise the applications of plant tissue culture in agriculture and horticulture sectors.	Level 2 (Understanding) Level 3 (Application)
CO 3	Acquire skills related to various aspects in plant tissue culture.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Evaluate the role of transgenic plants in solving certain plant related beneficiary issues.	Level 3 (Application) Level 4 (Analysing)
CO 5	Justify the role of plant biotechnology in bioenergy and phytoremediation.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO6	Judge the biosafety and bioethics related to plant biotechnology.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

III SEMESTER, COURSE 8: PLANT BIOTECHNOLOGY III. Syllabus of Theory:

UNIT-1: Basic techniques in plant tissue culture 10

- 1. Plant tissue culture: Definition, scope and significance; infrastructure and equipment required to establish a tissue culture laboratory.
- 2. Sterilization techniques; formulation of media for plant tissue culture.
- 3. Concept of totipotency, initiation and maintenance of callus cultures; induction of morphogenesis in vitro.
- 4. Somatic embryogenesis and organogenesis; factors affecting somatic embryogenesis and organogenesis synthetic seeds and their applications.

UNIT-2: Organ and haploid culture techniques

- 1. Importance and applications of meristem culture, zygotic embryo culture, endosperm culture.
- 2. Micropropagation and its uses, commercial exploitation of micropropagation.
- 3. Production of haploids using anther, pollen and unfertilized ovule cultures characterization and applications.

UNIT-3: Cell and protoplast cultures

1.Cell suspensions – continuous and batch cultures; mass cultivation of plant cells using bioreactors.

- 2. Production of secondary metabolites from cell cultures, strategies used for enhanced production of secondary metabolites. Biotransformation using plant cell cultures.
- 3. Isolation, purification and culture of protoplasts; methods used for protoplast fusion.
- 4. Somatic hybridization/cybridization –selection systems for somatic hybrids/cybrids, their characterization and applications.

UNIT-4: Transgenic plants

- 1. Transgenic plants definition, biosafety and ethical issues associated with transgenic plants.
- 2. Herbicide resistance (glyphosphate), insect resistance (alpha amylase inhibitor).
- 3. Virus resistance (coat protein mediated, nucleocapsid gene), disease resistance (antifungal proteins, PR proteins).
- 4. Quality improvement (Golden rice), Shelf-life enhancement (Flavr savr tomato).

t

12 Hrs.

8 Hrs.

8 Hrs.

10 Hrs.

UNIT-5: Advances in plant biotechnology

7 Hrs.

- 1. Plant synthetic biology and its applications; plant-based vaccines and therapeutics.
- 2. Biofortification and genetically modified foods.
- 3. Biodegradable plastics, polyhydroxybutyrate.
- 4. Applications of plant biotechnology in bioenergy production and environmental remediation.

Additional Inputs:

Unit I: Types of methods of Sterilization

Unit IV: Bt Cotton and Roundup Ready Soya Bean.

IV. Text Books:

- 1. Ignacimuthu , S., (2003) Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- Kalyan Kumar De., (1997) Plant Tissue Culture New Central Book Agency (P) Ltd., Calcutta.
- Mascarenhas A.F., (1991) Hand book of Plant Tissue Culture. Indian Council of Agricultural Research. New Delhi.
- Narayanaswamy, S (1994) Plant Cell and Tissue Culture, Tata –Mc Graw Hill Publishing Co., Ltd., New Delhi.

V. Reference Books:

- 1. C. Neal Stewart Jr. (2018) Plant Biotechnology and Genetics: Principles, Techniques, and Applications John Wiley & Sons, Inc. in Hoboken, New Jersey, USA.
- Adrian Slater, Nigel W. Scott, and Mark R. Fowler (2008) Plant Biotechnology: The Genetic Manipulation of Plants Oxford University Press in Oxford, UK.
- S. Mohan Jain and Pramod K. Gupta (2010) Plant Biotechnology: Methods and Applications CRC Press, Taylor & Francis Group in Boca Raton, Florida, USA.
- Ram Lakhan Singh (2017) Plant Biotechnology: Recent Advances and Future Prospects Springer International Publishing AG in Cham, Switzerland.
- Altman and P.M. Hasegawa (2013) Plant Biotechnology and Agriculture: Prospects for the 21st Century Elsevier Inc. in Amsterdam, Netherlands.

CO-PO Mapping

6- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2	2	2	1	2	1	-	2
CO 2	2	1	1	2	1	2	-	-	1
CO 3	2	2	1	2	1	1	1	1	2
CO 4	2	1	2	2	1	2	1	1	2
CO 5	3	2	1	2	1	3	2	2	2
CO 6	3	2	2	3	3	2	1	1	2

CO-PSO Mapping

6- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	1	2	1	2	1	2
CO 2	2	1	2	2	1	1	2
CO 3	1	1	2	1	1	2	3
CO 4	1	1	3	2	1	3	3
CO 5	2	1	3	1	2	2	2
CO 6	2	1	2	1	1	1	2

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Preparation of media for tissue culture.

Evaluation method: Assessment of skill in preparation of media in an effective manner. **Unit-2: Activity:** Group discussion on various tissue culture practices.

Evaluation method: Active participation, critical thinking, content presentaion, collaboration skills etc., based on a rubric.

Unit-3: Activity: Designing a bioreactor system for mass cultivation of plant cells. **Evaluation method:** Awarding grade based on skills performed in designing a prototype bioreactor.

Unit-4: Activity: Collection of scientific literature on various transgenic plants developed. **Evaluation method:** Assess credibility and relevance of literature collected, analysis and conclusions made.

Unit-5: Activity: Case studies on applications of plant biotechnology.

Assessment method: Based on data and Information collected, analysis and interpretation made, presentation and organization of the report.

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Paper-8: PLANT BIOTECHNOLOGY

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 = 20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 1. Totipotency.
- 2. Synthetic seeds
- 3. Micropropagation.
- 4. Biotransformation.
- 5. Herbicide resistance.
- 6. Flavrsavr tomato
- 7. Biofortification.
- 8. Biofuels.

Section – B

5×8= 40 MARKS

Answer any FIVE of the following Questions, Draw neat and labelled diagrams wherever necessary

9. a) Describe sterilization techniques used in plant tissue culture?

- b) Write an essay on somatic embryogenesis and organogenesis?
- 10. a) Describe the production of haploids using anther culture?

or

b) Write an essay on endosperm culture?

11. a) Write an essay on production of secondary metabolites from cell cultures?

or

b) Describe somatic hybridization and their selection systems?

12. a) Define transgenic plants and describe bio safety and ethical issues associated with transgenic plants?

or

b) Write an essay on virus resistance Plants?

13. a) Describe the applications of plant synthetic biology?

or

b) Explain different plant biotechnology applications in environmental remediation?

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Question Bank

Short Questions (4 Marks)

Unit – 1: Basic techniques in plant tissue culture

- 1. Significance of plant tissue culture.
- 2. Totipotency.
- 3. Callus culture.
- 4. Morphogenesis.
- 5. Synthetic seeds.

Unit – 2: Organ and haploid culture techniques.

- 6. Meristem culture.
- 7. Embryo rescue.
- 8. Micropropagation.
- 9. Applications of anther culture.
- 10. Ovule culture..

Unit – 3: Cell and protoplast cultures.

- 11. Cell suspension culture.
- 12. Bioreactors.
- 13. Biotransformation.
- 14. Protoplast culture.
- 15. Cybrids. .

Unit – 4: Transgenic plants.

- 16. Transgenic plants.
- 17. Herbicide resistance.
- 18. Insect resistance.
- 19. Golden rice.
- 20. Flavrsavr tomato.

Unit – 5: Advances in plant biotechnology.

- 21. Plant based vaccines.
- 22. Biofortification.
- 23. Biofuels.
- 24. Polyhydroxybutyrate.
- 25. Environment remediation.
Essay Questions (8 Marks)

Unit – 1: Basic techniques in plant tissue culture

- 1. Describe the infrastructure and equipment required to establish plant tissue culture laboratory.
- 2. Describe sterilization techniques used in plant tissue culture.
- 3. Write an essay on somatic embryogenesis and organogenesis.

Unit – 2: Organ and haploid culture techniques.

- 4. Write an essay on endosperm culture.
- 5. Describe the embryo culture technique.
- 6. Explain the production of haploids using anther culture.

Unit – 3: Cell and protoplast cultures.

- 7. Describe production of secondary metabolites in cell cultures.
- **8.** Explain the process of somatic hybridization, characterization of somatic hybrids and their applications.

Unit – 4: Transgenic plants.

- 9. Explain the biosafety and ethical issues associated with transgenic plants.
- **10.** Explain the production of virus resistant plants through transgenic approach.
- **11.** Explain the production of disease resistant plants through genetic engineering.

Unit – 5: Advances in plant biotechnology.

- 12. Describe the applications of plant synthetic biology.
- 13. Explain bio fortification of crops through genetic engineering.
- 14. Write an essay on applications of plant biotechnology in bioenergy production.
- 15. Describe the applications of plant biotechnology in environmental remediation.

Semester – III, Course 8: Plant Biotechnology

Credits -1

I. Laboratory/field exercises:

- 1. Equipment used in plant tissue culture.
- 2. Sterilization techniques in plant tissue culture laboratory.
- 3. Preparation of culture media
- 4. Callus induction and subculturing.
- 5. Organogenesis using PGRs'
- 6. Demonstration of cell and protoplast culture.
- 7. Demonstration of organ cultures.
- 8. Demonstration of anther and pollen cultures.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

- 1. Experiment-1 (Steps involved in Plant tissue culture) 10 M
- 2. Experiment-2 (Somatic embryogenesis procedure) 10 M
- 3. Spotters $3 \times 5 = 15 \text{ M}$
 - Autoclave
 - Golden rice
 - Flavr Savr Tomato
- 4. Record + Viva-voce 10 + 5 = 15 M

SEMESTER – III, COURSE 9: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To know about various types of tissues in plants and their organization.
- 2. To obtain awareness on anomalous secondary growth in plants and economic value of woods.
- 3. To acquire knowledge on development of male and female gametophytes in plants.
- 4. To probe into embryogenesis in angiosperms.
- II. Learning Outcomes: On completion of this course students will be able to:

On Co	mpletion of the course, the students will be able to	Knowledge level
		(Bloom's Taxonomy)
CO 1	Categorize various tissues and evaluate their role in plants	Level 1 (Knowledge)
CO 2	Explain anomalous secondary growth in some plants and justify the value of timber plants.	Level 2 (Understanding)
CO 3	Summarize the events in micro-sporogenesis and development of male gametophyte.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Discuss the events in mega-sporogenesis and development of female gametophyte.	Level 3 (Application) Level 4 (Analysing)
CO 5	Propose the incidents in embryogenesis of an angiospermic plant species.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO6	Compile the aspects of developmental and reproductive biology in plants.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER – III, COURSE 9: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS **III. Syllabus of Theory:**

Unit – 1: Tissues in plants

- 1. Meristematic tissues: Definition, classification, structure and functions.
- 2. Apical meristems: Generalised structure of shoot apex, theories on organization of Shoot Apical Meristem (SAM) - Apical cell theory, Tunica-Corpus theory and Histogen theory.
- 3. Permanent tissues (simple and complex).
- 4. A brief account of plant secretary tissues/cells.

Unit-2: Anomalous growth in plants

- 1. Tissue systems–Epidermal, ground and vascular.
- 2. Anomalous secondary growth in root of *Beta vulgaris*
- 3. Anomalous secondary growth in stems of Boerhaavia and Dracaena
- 4. Study of timbers of economic importance Teak, Red-sanders and Rosewood.
- 5. Applications of anatomy in plant systematics, forensics and pharmacognosy.

Unit-3: Anther and pollen

- 1. Anther: Structure and functions of anther wall, micro-sporogenesis, callose deposition and its significance.
- 2. Pollen wall structure, MGU (male germ unit) structure, NPC system; a brief account of Palynology and its scope; development of male gametophyte.
- 3. Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: pseudomonads, polyads, massulae, pollinia.

Unit-4: Ovules, fertilization and endosperm

- 1. Structure and types of ovules, megasporogenesis; monosporic (*Polygonum*), bisporic (Allium) and tetrasporic (Peperomia) types of embryo sacs.
- 2. Outlines of pollination; self-incompatibility- basic concepts; methods to overcome selfincompatibility (mixed pollination, bud pollination, stub pollination).
- 3. Double fertilization in angiosperms process and consequences.
- 4. Perisperm; endosperm types (free nuclear, cellular, helobial and ruminate) and biological importance.

Unit-5: Embryogeny and seeds

- 1. Embryogeny in dicot (*Capsella bursa-pastoris*)
- 2. Embryogeny in monocot (Sagittariasagittifolia).
- 3. Seed structure in monocot and dicot.
- 4. Importance of seed and seed dispersal mechanisms.
- 5. Polyembryony and apomixes: Introduction, classification, causes and applications.

Additional Inputs:

Unit III: Nemec Phenomenon

10Hrs.

7Hrs.

10Hrs.

10Hrs.

8 Hrs.

IV.Text Books:

- 1. Pandey, B.P. (2013) College Botany, Volumes-II& III, S. Chand Publishing, New Delhi
 - Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, NewCentral Book Agency Pvt. Ltd., Kolkata

V.Reference Books:

- 1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
- 2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
- Cutler, D.F., T. Botha & D. Wm. Stevenson (2008)Plant Anatomy: An Applied Approach, Wiley, USA

4.Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London

5.Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th

Ed.), Vikas Publishing House, Delhi.

- Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
- Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
- 8. Johri, B.M. (2011) Embryology of Angiosperms. Springer-Verlag, Berlin

CO-PO Mapping

7- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	2	-	-	-	1	-	-	1
CO 2	2	1	1	-	-	2	-	-	2
CO 3	2	1	-	-	-	1	-	-	1
CO 4	2	2	-	-	-	1	-	-	2
CO 5	1	1	-	-	-	-	-	-	1

CO-PSO Mapping

7- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	3	1	1	1	1	2
CO 2	2	3	2	1	1	2	2
CO 3	1	3	1	1	1	1	2
CO 4	1	2	1	1	1	1	2
CO 5	1	3	1	2	1	1	2
CO 6	1	2	1	2	1	1	2

9. Suggested activities and evaluation methods:

Unit-1: Activity: Microscopic observations on different tissues in plants and recording characteristics.

Evaluation method: Judgement of the report/seminar on comparative and contrasting features of various tissues in plants.

Unit-2: Activity: Visits to timber depots and furniture shops and making a report on various woods.

Evaluation method: Assessment of report submitted with data, photographs and summary.

Unit-3: Activity: Study of pollen structure, germination and viability in some local plant species.

Evaluation method: Evaluating the report/seminar presentation with collected data.

Unit-4: Activity: Group discussion/quiz on endosperm types and functions.

Evaluation method: Assessment of the best performing group.

Unit-5: Activity: Drawings of embryogeny in some angiosperms and making comparative report.

Evaluation method: Evaluating the best drawings and comparative report.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM

III B.Sc. (Botany) Major - Semester –V : Course-9 Theory Paper (w.e.f. 2023-2024)

Course-9: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS Time: 3 Hrs. Max. Marks: 60

SECTION – A MARKS 5×4 =20

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 4. Tunica corpus theory
- 5. Sclereids
- 6. Economic importance of teak
- 7. Pollinia
- 8. Explain development of male gametophyte
- 9. Double fertilization in angiosperms
- 10. Ruminate endosperm
- 11. Apomixis

SECTION – B

5×8= 40 MARKS

Answer any Five of the following Questions, Draw neat and labelled diagrams wherever necessary

- 9. a) Explain the theories on organization of Shoot Apical Meristem?
 - (Or)

b) Give an account of sclerenchyma?

10.a) Describe Anamolous secondary growth in Boerhavia?

(Or)

b) Write about Anomalous secondary growth in root of Beta vulgaris?

11.a) Describe the structure of Anther and Microsporogenesis mechanism?

(Or)

b) Define Pollen viability and Describe the storage methods and pollen germination?

12.a) Give an account of Tetrasporic type of embryo sac?

(Or)

b) Explain different types of Endosperms?

13. a) Explain the Embryogeny in dicot (Capsella bursa-pastoris)?

(Or)

b) What is Polyembryony and Describe the classification, causes and applications of Polyembryony?

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Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester –IV: Course-9 Theory Paper (w.e.f. 2023-2024) Course-9: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS Question Bank

SHORT QUESTIONS (4 MARKS)

Unit – 1: Tissues in plants

- 1. Structure and functions of Meristematic tissues
- 2. Tunica corpus theory
- 3. Histogen theory
- 4. Apical cell theory
- 5. Structure and functions of parenchyma
- 6. Structure and functions of Collenchyma
- 7. Sclerenchyms fibres
- 8. Sclereids
- 9. Secretory tissues

Unit-2: Anomalous growth in plants

- 1. Economic importance of teak
- 2. Economic importance of red sanders
- 3. Economic importance of rose wood
- 4. Applications of anatomy in plant systematics
- 5. Applications of anatomy in forensics
- 6. Applications of anatomy in pharmacognosy

Unit-3: Anther and pollen

- 1. Give a brief account of scope of Palynology.
- 2. Explain development of male gametophyte
- 3. Pollen wall proteins;
- 4. Pollen viability
- 5. Pseudomonads,
- 6. Polyads,
- 7. Massulae,
- 8. Pollinia

Unit – 4: Ovules, fertilization and endosperm

- 1. Double fertilization in angiosperms
- 2. Anatropous ovules
- 3. Campylotropous ovules
- 4. Hemitropous Ovules
- 5. Perisperm
- 6. Free nuclear endosperm
- 7. Cellularendosperm
- 8. Helobial endosperm
- 9. Ruminateendosperm

Unit – 5:Embryogeny and seeds

- 1. Apomixis
- 2.Seed dispersal mechanism
- 3.Dicot Seed structure
- 4. Monocot Seed structure

ESSAY QUESTIONS (8 MARKS)

Unit – 1: Tissues in plants

- 1. Explain the theories on organization of Shoot Apical Meristem.
- 2. Give an account of elements of xylem
- 3. Give an account of sclerenchyma.

Unit-2: Anomalous growth in plants

- 1. Anamolous secondary growth in Boerhavia.
- 2. Anamolous secondary growth in Dracaena.
- 3. Anomalous secondary growth in root of Beta vulgaris.
- 4. Explain the vascular tissue system in detail.

Unit – 3: Anther and pollen

- 1. Describe the structure of Anther and Microsporogenesis mechanism.
- 2. What is the NPC system classification? Write the merits of it
- 3. Define Pollen viability describe the storage methods and pollen germination.

Unit - 4Ovules, fertilization and endosperm

- 1. Give an account of Structure and types of ovules.
- 2. Give an account of monosporic (Polygonum), bisporic
- 3. Give an account of Tetrasporic type of embryo sac.
- **4.** Explain the types of endosperms.

Unit – 5: Embryogeny and seeds

- 1. Explain the Embryogeny in dicot (Capsella bursa-pastoris)
- 2. Explain the Embryogeny in monocot (Sagittariasagittifolia).
- What is Polyembryony and Describe the classification, causes and applications of Polyembryony

IV SEMESTER, COURSE 9: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

CREDITS -1

Laboratory/field exercises:

- 1. Observation of meristems in dicot and monocot plants.
- 2. Tissue organization in shoot apices using permanent slides.
- 3. Anomalous secondary growth in root of Beta vulgaris
- 4. Anomalous secondary growth in stems of Boerhaavia and Dracaena.
- 5. Study of anther and ovule s using permanent slides/photographs.
- 6. Study of pollen germination and pollen viability.
- 7. Dissection and observation of embryo sac haustoria in *Santalum* or *Argemone*.
- 8. Structure of endosperm (nuclear and cellular) using permanent slides/photographs.
- 9. Dissection and observation of Endosperm haustoria in Crotalaria or Coccinia.
- 10. Developmental stages of dicot and monocot embryos using permanent slides/photographs.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

 $3 \ge 5 = 15 M$

- 1. Experiment-1 (Section cutting A) 10 M
- 2. Study of wood (Any 2) 2X5=10 M
 - Teak
 - Rose wood
 - Red Sanders
- 3. Spotters
 - Embryology slides
- 4. Record + Viva-voce 10 + 5 = 15 M

SEMESTER – IV, COURSE 10: PLANT ECOLOGY, BIODIVERSITY AND PHYTOGEOGRAPHY

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To figure-out the components of ecosystem and energy flow among different trophic levels.
- 2. To apprise the characteristics of autecology and synecology.
- 3. To understand the climatic change and associated impacts on biotic components.
- 4. To discern the value of biodiversity, threats and conservation strategies.
- 5. To know the distribution of various plant groups in different geographical areas.

II. Learning Outcomes: On completion of this course students will be able to:

On Co	ompletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Explain the interactions among the biotic and abiotic components in an ecosystem.	Level 1 (Knowledge)
CO 2	Summarize the characteristics of a population and a community.	Level 2 (Understanding)
CO 3	Anticipate the environmental problems arising due to climate change.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Assess the value of biodiversity and choose appropriate conservation strategy.	Level 3 (Application) Level 4 (Analysing)
CO 5	Make a survey on the distribution of various plant groups in a specified geographical area.	Level 2 (Understanding) Level 3 (Applying)
		Level 4 (Analysing)

SEMESTER – IV, COURSE 10: PLANT ECOLOGY, BIODIVERSITY AND **PHYTOGEOGRAPHY**

III. Syllabus of Theory:

Unit-1: Basic concepts in ecology

1. Ecology: definition, branches and significance; relation with other sciences.

2. Structure and functions of ecosystems- abiotic and biotic components; flow of energy.

- 3. Cycling of materials: water, carbon, nitrogen and phosphorus; trophic pyramids, food chains and food webs.
- 4. Plants and environment: Climatic (light and temperature) and edaphic.
- 5. Interactions among plants; interactions between plants and animals.

Unit-2: Population and community ecology

- 1. Population ecology: definition, characteristics natality, mortality, growth curves, ecotypes, ecads.
- 2. Community ecology: characteristics -frequency, density, cover, life forms, competition, biological spectrum.
- 3. Ecological succession: Hydrosere and Xerosere.
- 4. Concepts of productivity: GPP, NPP and Community Respiration
- 5. Secondary production, P/R ratio and Ecosystems.

Unit-3: Climate change-impacts

- 1. Soil degradation causes, consequences and management strategies.
- 2. Deforestation, forest fires causes, consequences and management strategies.
- 3. Global warming, ozone layer depletion, acid rains, ocean acidification causes and effects.
- 4. Carbon foot prints and carbon credits; The Montreal and the Kyoto protocol.
- 5. Plant indicators and their role in environmental monitoring.

Unit-4: Concepts of Biodiversity

- 1. Biodiversity: Basic concepts, Convention on Biodiversity Earth Summit.
- 2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
- 3. Biodiversity Hot spots in India: North Eastern Himalayas and Western Ghats.
- 4. Principles of conservation: IUCN threat-categories, RED data book
- 5. Role of NBPGR and NBA in the conservation of Biodiversity.

Unit-5: Phytogeography

- 1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
- 2. Endemism types and causes.
- 3. Phytogeographic regions of World.
- 4. Phytogeographic regions of India.
- 5. Vegetation types in Andhra Pradesh.

Additional Inputs:

Unit I: Trophic levels and Ecological pyramids

Deleted: Trophic Pyramids and Community Respiration

7 Hrs.

8Hrs.

10 Hrs.

10Hrs.

IV. Text Books:

- 1. Pandey, B.P. (2013) College Botany, Volumes- II & III, S. Chand Publishing, New Delhi
- 2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, VolumeII, New Central Book Agency Pvt. Ltd., Kolkata
- 3. N.S.Subrahmanyam& A.V.S.S. Sambamurty (2008) Ecology Narosa Publishing House, New Delhi
- 4. Sharma, P.D. (2012) Ecology and Environment. Rastogi Publications, Meerut, India.
- 5. U. Kumar (2007) Biodiversity: Principles & Conservation, Agrobios (India), Jodhpur
- 6. Mani, M.S (1974) Ecology & Biogeography of India Dr. W. Junk Publishers, The Hague

V. Reference Books:

- 1. Kormondy, Edward J. (1996) Concepts of Ecology, Prentice-Hall of India Private Limited, New Delhi
- 2. Begon, M., J.L. Harper & C.R. Townsend (2003) Ecology, Blackwell Science Ltd., U.S.A.
- 3. Eugene P. Odum (1996) Fundamentals of Ecology, Natraj Publishers, Dehradun
- 4. Kumar, H.D. (1992) Modern Concepts of Ecology (7th Edn.,)Vikas Publishing Co.,New Delhi.
- 5. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
- 6. Chapman, J.L&M.J. Reiss (1992): Ecology Principles & Applications. Cambridge University Press, U.K.
- 7. Kumar H.D. (2000) Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co Ltd. New Delhi.
- 8. Cain, S.A. (1944) Foundations of Plant Geography Harper & Brothers, N.Y.
- 9. Good, R. (1997) The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi

CO-PO Mapping

8- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2	-	-	-	3	-	-	2
CO 2	2	2	-	-	-	2	1	-	1
CO 3	3	1	3	3	2	3	-	-	2
CO 4	3	3	2	2	3	3	1	-	2
CO 5	2	2	1	-	-	2	-	-	1

CO-PSO Mapping

8- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	1	1	1	1	1
CO 2	2	3	1	1	1	1	1
CO 3	2	3	1	1	1	1	1
CO 4	3	3	1	1	1	1	1
CO 5	3	3	1	1	1	1	1

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Field visit to local ecosystems and making a report on biotic and abiotic components and their interactions.

Evaluation method: Valuation of record of attendance and report submission with conclusions **Unit- 2: Activity:** Case studies on population and community ecologies and making a comprehensive report

Evaluation method: Assessing the report and awarding grade

Unit -3: Activity: Case studies on global and local climatic changes and their impacts, preparing a comprehensive report.

Evaluation method: Assessing the report and awarding grade.

Unit- 4: Activity: Making a survey in their locality to identify endangered and threatening species.

Evaluation method: Assessing the survey report and assigning a grade based on a rubric.

Unit-5: Activity: Collection of data on flora of their locality and preparing a project report.

Evaluation method: Assessing the project report and awarding a grade.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM

III B.Sc. (Botany) Major - Semester – IV : Course-10 Theory Paper (w.e.f. 2023-2024)

Semester – IV, Course 10: Plant Ecology, Biodiversity and Phytogeography Time: 3 Hrs. Max. Marks: 60

Section – A

5X4 = 20 Marks

I. Write any **FIVE** of the following questions, Draw neat and labelled diagrams wherever necessary

- 1. Flow of energy.
- 2. Food chains
- 3. Ecotypes,
- 4. P/R ratio
- 5. Global warming
- 6. Ozone layer depletion
- 7. Red data book
- 8. Endemic species.

<u>SECTION – B</u>

5×8= 40 MARKS

II. Answer any **FIVE** of the following Questions, Draw neat and labelled diagrams wherever necessary

1. a) Describe Edaphic factor in detail?

(Or)

- b) Write an essay on nitrogen cycle?
- 2. a) Write an essay on population characteristics? (Or)
 - b) Give a detailed account of Hydrosere?
- **3.** a) Describe the causes Soil degradation causes, consequences ? (Or)
 - b) Write an essay on role of plant indicators in environmental monitoring?
- 4. a) Write an essay on types and levels of biodiversity? (Or)
- b) Give an account of Biodiversity Hot spots in India?
- 5. a) Write an essay on Causes and types of endemism? (Or)

b) Give an account of Phytogeographic regions of India?

Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester –IV: Course-10 Theory Paper (w.e.f. 2023-2024) Course-10: PLANT ECOLOGY, BIODIVERSITY AND PHYTOGEOGRAPHY

QUESTION BANK

SHORT QUESTIONS (4 MARKS)

Unit: Basic concepts in ecology

- 1. Flow of energy.
- 2. Ecology: definition and significance.
- 3. Biotic components
- 4. Biological nitrogen fixation.
- 5. Phosphorous cycle
- 6. Trophic pyramids,
- 7. Food chains and
- 8. Food webs.

Unit-2: Population and community ecology

- 9. Ecotypes,
- 10. Ecads
- 11. Gross Primary Productivity (GPP),
- 12. P/R ratio

Unit-3: Climate change-impacts

- 13. Deforestation
- 14. Global warming
- 15. Ozone layer depletion
- 16. Acid rains
- 17. Montreal protocol.
- 18. Carbon foot prints.

Unit – 4: Concepts of Biodiversity.

- 19. Earth Summit.
- 20. NBPGR
- 21. Red data book
- **22.** IUCN

Unit – 5: Phytogeography

- 23. Discontinuous species.
- 24. Endemic species.
- 25. Vegetation types in Andhra Pradesh

ESSAY QUESTIONS (8 MARKS)

Unit-1: Basic concepts in ecology.

- 1. Describe Edaphic factor in detail.
- 2. Describe light factor in detail.
- 3. Describe and temperature factor in detail.
- 4. Give an account of abiotic and biotic factors.
- 5. Write an essay on nitrogen cycle.

Unit-2:Population and community ecology

- 1. Write an essay on population characteristics.
- 2. Write an essay on characteristics of community ecology.
- 3. Give a detailed account of Hydrosere.
- 4. Give a detailed account of Xerosere.

Unit – 3:Climate change-impacts

- 1. Describe the Soil degradation causes and management strategies
- 2. Describe the causes Soil degradation causes, consequence
- **3.** Write an essay on role of plant indicators in environmental monitoring.

Unit – 4 Concepts of Biodiversity

- **1.** Write an essay on value of biodiversity
- 2. Write an essay on types and levels of biodiversity.
- 3. Write an essay on threats to biodiversity.
- 4. Give an account of Biodiversity Hot spots in India.

Unit – 5: Phytogeography

- 1. Write an essay on Causes and types of endemism.
- 2. Give an account of Phytogeographic regions of the world.
- 3. Give an account of Phytogeographic regions of India

SEMESTER – IV, COURSE 10: PLANT ECOLOGY, BIODIVERSITY AND PHYTOGEOGRAPHY

Credits -1

I. Laboratory/field exercises:

- 1. Study of instruments used to measure microclimatic variables;
 - a. Soil thermometer,
 - b. Maximum and minimum thermometer,
 - c. Anemometer,
 - d. Rain gauze
 - e. Lux meter.
- 2. Visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical.
- 3. Study of morphological and anatomical adaptations of any two hydrophytes.
- 4. Study of morphological and anatomical adaptations of any two xerophytes.
- 5. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance
- 6. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.
- 7. Find out the alpha-diversity of plants in an area
- 8. Mapping of biodiversity hotspots of the world and India.
- 9. Mapping of phytogeographical regions of the globe and India.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

- 1. Experiment-1 (Section cutting Hydrophytes) 10 M
- 2. Experiment-2 (Section cutting Xerophyte) 10 M
- 3. Spotters (Ecology instruments) $2 \times 5 = 10 \text{ M}$
- 4. Mapping of Biodiversity Hotspot/Phytogeographical region 5 M
- 5. Record + Viva-voce 10 + 5 = 15 M

SEMESTER – IV, COURSE 11: PLANT RESOURCES AND UTILIZATION

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To know different plants domesticated by humans and utility of their products.

- 2. To gain knowledge on commercial and timber products obtained from plants.
- 3. To know the facts on economic value of plants products in relation to human welfare.

II. Learning Outcomes: Students at the successful completion of the course will be able to:

On Co	ompletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Explain the significance of plants in human nutrition.	Level 1 (Knowledge)
CO 2	List out different plant products used by human beings.	Level 1 (Knowledge)
CO 3	Evaluate the commercial plant products and their utilization	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Discuss the uses of medicinal and aromatic plants for human health care.	Level 2 (Understanding) Level 3 (Application) Level 4 (Analysing)
CO 5	Appraise the importance of timber and non-timber products for value added products.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER – IV, COURSE 11: PLANT RESOURCES AND UTILIZATION **III. Syllabus of Theory:**

UNIT-1: Food plants

10 Hrs.

- 1. Centres of diversity of plants, origin of crop plants.
- 2. Domestication and introduction of crop plants; concepts of sustainable development.
- 3. Cultivation, production, and uses of cereals (rice and wheat), major (jowar and bajra) and minor millets (finger millet, fox tail millet), pulse crops (red gram and black gram) and sugarcane.

UNIT-2: Other economic plant products 8 Hrs.

- 1. A general account of oil seed crops and vegetable oils.
- 2. A general account of fruit and vegetable yielding plants.
- 3. Plant sources and economic importance of rubber, latex, gums, resins, dyes, alkaloids and tannins.
- 4. A general account of major fibre crops in India; textile production from plant fibres.

UNIT-3: Commercial plant products

- 1. A general account and economic potential of spices and condiments.
- 2. Plant sources and economic importance of flavouring products, beverages, fumitories and masticatories and narcotics.
- 3. Utilization of some important ornamentals, flowering plants and orchids.

UNIT-4: Medicinal and aromatic plant products 10 Hrs.

- 1. Traditional and modern uses of some medicinal plants of India.
- 2. Active compounds in medicinal plants and their pharmacological effects.
- 3. Essential oils and their uses; aromatic plants in perfumery and cosmetics.
- 4. Phytochemicals and their potential health benefits.

UNIT-5: Timber products and energy crops

- 1. Important timber yielding plants of India; wood as a construction and manufacturing material.
- 2. Other uses of wood products, such as paper and fuel.
- 3. Energy crops, biofuels and bioplastics.
- 4. Bamboos, Eucalyptus, Casuarina generation of paper industry raw material.

Additional Inputs:

Unit V: Tectona grandis, Pterocarpus santalinus and Dalbergia latifolia

8 Hrs.

9 Hrs.

IV. Textbooks:

- 1. S. K. Jain and R. A. Jain, (2015) Handbook of Plant Resources, Springer, New York.
- 2. H. Panda and A. K. Padhi, (2017) Medicinal Plants and Their Utilization, Springer, Singapore.
- 3. G.E. Wickens (1998) Economic Botany: Principles and Practices, Chapman & Hall, London.
- 4. S.L. Kochhar (1990) The Economic Botany of the Tropics, Macmillan, London.

V. Reference Books:

- 1. K. V. Peter, (2004) Handbook of Herbs and Spices, CRC Press, Boca Raton.
- 2. J. E. Simon, J. A. Duke, and E. A. L. Bobilya, (1990) Handbook of Edible Weeds, CRC Press, Boca Raton.
- 3. J. Smartt and N. Haq, (2016) Handbook of Industrial Crops, Springer, New York.
- 4. P. N. Ravindran, (2017) The Encyclopaedia of Herbs and Spices, CABI, Wallingford.
- 5. Beryl B. Simpson (2010) Economic Botany: Plants in Our World, Academic Press, London.
- 6. Michael J. Balick and Paul Alan Cox (1996) Plants, People, and Culture: The Science of Ethnobotany, Scientific American Library, New York.
- 7. Ben-Erik van Wyk (2016) Food Plants of the World: An Illustrated Guide, Timber Press, Portland.
- 8. Jo Homan (2012) Plants That Changed History, Chartwell Books, New York.
- 9. Gary J. Martin (2004) Ethnobotany: A Methods Manual, Earthscan Publications, London.

	CO-PO Mapping											
9- Low, 2- Moderate, 3- High, '-' No Correlation												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9			
CO 1	3	3	2	1	-	1	2	1	2			
CO 2	2	2	1	-	-	1	1	-	2			
CO 3	3	2	3	1	1	2	1	-	2			
CO 4	3	3	2	1	-	2	1	-	2			
CO 5	2	2	2	2	2	3	1	2	2			

CO-PSO Mapping

9- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	2	2	1	1	2	3
CO 2	2	1	2	1	1	3	3
CO 3	2	1	1	1	1	3	2
CO 4	2	1	2	1	1	2	2
CO 5	2	1	2	1	1	2	2

VI. Suggested activities and evaluation methods:

Unit-1: Activity: A critical assignment on origin of crop plants.

Evaluation method: Evaluate the extent and quality of data collected to support the assignment's arguments.

Unit-2: Activity: Group discussion on various plant products and their source plants. **Evaluation method:** Assess the logical flow and coherence of the group's discussion based on a grading scale.

Unit-3: Activity: A survey report on commercial plant products available in local markets.

Evaluation method: Evaluate the clarity and comprehensibility of the survey questions.

Unit-4: Activity: A case study report on phytomedicines used in human health care. **Evaluation method:** Examine the depth and coherence of the discussion and interpretation based on a rubric.

Unit-5: Activity: A field trip to timber depots and silviculture plantations in their locality. **Evaluation method**: Evaluate the level of student engagement and active participation during the trip based on a grading scale.

DR. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM II B.Sc. Botany Major - Semester -IV : Course-11 Theory Paper (w.e.f. 2023-2024) Paper-11: PLANT RESOURCES AND UTILIZATION

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 3. Sustainable development
- 2. Uses of Millets
- 3. Alkaloids
- 4. Flavouring products
- 5. Andrographis
- 6. Plants in perfumery
- 7. Biofuels
- 8. Bioplastics

Section – B

5×8= 40 MARKS

Answer ALL the following Questions, Draw neat and labelled diagrams wherever necessary

1. a) Write about Origin of crop plants?

(Or)

- b) Explain the Concept of sustainable development?
- 2. a) Discuss plant sources and economic importance of Dyes? (Or)

b) Give a general account of major Fibre crops in India?

- 3. a) General account and economic potential of Spices and Condiments? (Or)
 - b) Describe the plant sources and economic importance of Beverages?
- 4. a) Write an essay on Essential oils and their uses?

(Or)

b) Describe Phytochemicals and their potential health benefits?

5. a) Write an essay on Energy crops?

(Or)

b) What are Biofuels and discuss the use of plants in the production of Biofuels?

DR. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM II B.Sc. Botany Major - Semester -IV : Course-11 Theory Paper (w.e.f. 2023-2024) Paper-11: PLANT RESOURCES AND UTILIZATION

Question Bank (Short answer Questions, 4 Marks)

Unit – 1: Food Plants

- 1. Sustainable development
- 2. Plant Introduction
- 3. Uses of Millets
- 4. Uses of Minor millets
- 5. Uses of Major millets
- 6. Uses of Rice
- 7. Uses of Wheat
- 8. Uses of Pulses
- 9. Uses of Sugarcane

Unit – 2: Other economic plant products

- 1. Oil seed crops
- 2. Vegetable oils.
- 3. Plants yielding Gums
- 4. Plants yielding resins
- 5. Plant sources of Rubber.

Unit – 3: Commercial plant products

- 1. Spices
- 2. Condiments
- 3. Flavouring products
- 4. Beverages.

Unit – 4: Medicinal and Aromatic plants

- 1. Medicinal importance of Catharanthus
- 2. Medicinal importance of *Withania*
- 3. Traditional and modern uses of Rauvolfia
- 4. Medicinal importance of Curcuma
- 5. Traditional and modern uses of Andrographis
- 6. Traditional medicine
- 7. Active compounds in medicinal plants
- 8. Essential oils
- 9. Aromatic plants
- 10. Plants in perfumery
- 11. Plants in cosmetics.

Unit – 5: Timber products and Energy crops

- 1. Important timber yielding plants of India. 6. Biofuels
- 2. Wood as construction material
- 3. Wood as manufacturing material
- 4. Wood product Paper
- 5. Energy crops

5. Fumitories and Masticatories.

10. Textile production

- 6. Narcotics.
- 7. Ornamental plants

6. Dyes.
7. Alkaloids

8. Tannins.

9. Fibre crops

8. Orchids.

- 7. Bio-plastics
- 8. Bamboo
- 9. Eucalyptus
- 10.Casuarina

DR. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM II B.Sc. Botany Major - Semester –IV : Course-11 Theory Paper (w.e.f. 2023-2024) Paper-11: PLANT RESOURCES AND UTILIZATION <u>Question Bank(Essay Questions, 8 Marks)</u>

Unit – 1: Food Plants

- 1. Origin of crop plants.
- 2. Discuss the centres of diversity of plants.
- 3. Write an essay on Domestication and Introduction of Crop plants.
- 4. Concept of sustainable development .
- 5. Describe the cultivation, production and uses of Rice
- 6. Detailed account of cultivation, production and uses of Wheat.
- 7. Give an account of cultivation, production and uses of Jowar.
- 8. Describe the cultivation, production and uses of Bajra.
- 9. Give an account of cultivation, production and uses of minor millets.
- 10. Detailed account of cultivation, production and uses of Pulse crops.
- 11. Describe the cultivation, production and uses of Sugarcane.

Unit – 2: Other economic plant products

- 1. Give a general account of oil seed crops and vegetable oils.
- 2. Detailed account of fruit yielding plants.
- 3. Give an account of Vegetable yielding plants.
- 4. Discuss plant sources and economic importance of Rubber.
- 5. Discuss plant sources and economic importance of Dyes.
- 6. Discuss plant sources and economic importance of Alkaloids and Tannins.
- 7. Give a general account of major Fibre crops in India.

Unit – 3: Commercial plant products

- a. General account and economic potential of Spices and Condiments.
- b. Describe the plant sources and economic importance of Flavouring products.
- c. Describe the plant sources and economic importance of Beverages.
- d. Describe the plant sources and economic importance of Fumitories and Masticatories.
- 5. Describe the plant sources and economic importance of Narcotics.
- 6. Write an essay on utilization of some important Ornamental plants.
- 7. Write an essay on utilization of some important Orchids.

Unit - 4: Medicinal and Aromatic plants

1. Traditional and modern uses of famous medicinal plants of India.

- 2. Discuss any 8 active plant medicinal compounds and their pharmacological effects.
- 3. Write an essay on Essential oils and their uses.
- 4. Describe the use of Aromatic plants in perfumes and cosmetics.
- 5. Describe Phytochemicals and their potential health benefits.

Unit – 5: Timber products and Energy crops

- 1. What are the important timber yielding plants of India.
- 2. Discuss the uses of wood products such as paper and fuel.
- 3. Write an essay on Energy crops.
- 4. What are Biofuels and discuss the use of plants in the production of Biofuels.

5. Give a detailed account of generation of raw material for paper industry from Bamboo,

Eucalyptus and Causurina.

SEMESTER - IV, COURSE 11: PLANT RESOURCES AND UTILIZATION

Credits -1

I. Laboratory/field exercises:

- 1. Study of morphology and micro-chemical test for stored material of any 3 food crops.
- 2. Study of morphology and microscopic study anatomy of some plant fibres (cotton, jute, hemp, ramie, sisal).
- 3. Study of morphology, medicinal and aromatic plants and their useful parts.
- 4. Study of some oil yielding crops and properties of their oils.
- 5. Study of some gum, resin, tannin, dye yielding plants.
- 6. Study of firewood, biofuel and timber yielding plants.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.	Max. Marks: 50
1. Morphology and microchemical test of Food crop	10 M
2. Morphology and microscopic study Plant fibres	10 M
3. Morphology and Medicinal uses	$2 \ge 5 = 10 M$
4. Oil/Gum/Dye/Timber yielding plant	5 M
5. Record + Viva-voce	10 + 5 = 15 M

SEMESTER - V, COURSE 12: CELL BIOLOGY AND GENETICS

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To look into the ultra-structure of plant cell and its organelle
- 2. To know the morphology and functions of chromosomes
- 3. To understand the principles of genetics, structure and functions of gene
- **II. Learning Outcomes:** On completion of this course students will be able to:

On Con	pletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Sketch the ultra-structural aspects of plant cell and its components.	Level 1 (Knowledge)
CO 2	Hypothesise the role of chromosomes in inheritance.	Level 2 (Understanding)
CO 3	Justify the role of genes in inheritance of characters by descent.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Correlate the functions of the nucleic acid with their structure.	Level 3 (Application) Level 4 (Analysing)
CO 5	Explain the discoveries led to understand the fine structure of a gene.	Level 2 (Understanding) Level 3 (Applying)
		Level 4 (Analysing)

SEMESTER - V, COURSE 12: CELL BIOLOGY AND GENETICS III. Syllabus of Theory:

Unit-1: Cell and its organelle

- 1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
- 2. Ultra-structure of cell wall.
- 3. Ultra-structure of plasma membrane and various theories on its organization.
- 4. Polymorphic cell organelles (Plastids); ultra structure of chloroplast, plastid DNA.
- 5. Ultrastructure of mitochondria, mitochondrial DNA.

Unit-2: Chromosomes

- 1. Prokaryotic vs eukaryotic chromosome; morphology of a eukaryotic chromosome.
- 2. Euchromatin and Heterochromatin; Karyotype and ideogram.
- 3. Brief account of chromosomal aberrations structural and numerical changes
- 4. Organization of DNA in a chromosome (nucleosome and solenoid models).

Unit-3: Mendelian and non-Mendelian Genetics 10 Hrs.

- 1. Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
- 2. Complementary, supplementary and duplicate gene interactions (plant-based examples are to be dealt).
- 3. A brief account of linkage and crossing over; Chromosomal mapping 2 point and 3 point test cross.
- 4. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*).

Unit-4: Structure and function of DNA

- 1. Watson and Crick model of DNA. Brief account on DNA Replication (Semiconservative method).
- 2. Brief account on transcription, types and functions of RNA.
- 3. Genetic code and a brief account of translation.
- 4. Regulation of gene expression in prokaryotes Lac Operon.

Unit-5: Gene concept and Sex determination

- 1. Evolution of gene concept: classical vs molecular concepts of gene.
- 2. Cis–Trans complementation test for functional allelism, gene as unit of function, mutation and recombination.
- 3. Pattern of sex determination in plants.
- 4. Allele and genotype frequencies, Hardy-Weinberg law.
- t

8 Hrs.

10 Hrs.

9 Hrs.

8 Hrs.

Additional Inputs:

Unit I: Brief account of important cell organelles

IV. Text Books:

- 1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
- Ghosh, A.K., K.Bhattacharya&G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata
- 3. A.V.S.S. Sambamurty (2007) Molecular Genetics, Narosa Publishing House, New Delhi
- 4. S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, New Delhi

V. Reference Books:

- 1. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
- 2. B. D. Singh (2008) Genetics, Kalyani Publishers, Ludhiana
- 3. Cooper, G.M. & R.E. Hausman (2009) The Cell A Molecular Approach, A.S.M. Press, Washington
- 4. Becker, W.M., L.J. Kleinsmith& J. Hardin (2007) The World of Cell, Pearson, Education, Inc., New York
- 5. De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002) Cell and Molecular Biology, Lippincott Williams & Wilkins Publ., Philadelphia
- 6. Robert H. Tamarin (2002) Principles of Genetics, Tata McGraw –Hill Publishing Company Limited, New Delhi.
- 7. Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) Principles of Genetics, John Wiley & Sons Inc., New York
- 8. Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) DNA Science: A First Course, I.K.International Pvt. Ltd., New Delhi

CO-PO Mapping

10-Low, 2-Moderate, 3-High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	1	2	-	-	-	-	-	-	2
CO 2	2	2	-	-	1	-	-	-	1
CO 3	2	2	1	1	1	1	-	-	2
CO 4	2	2	-	-	-	-	-	-	2
CO 5	3	2	-	-	-	-	-	-	1

CO-PSO Mapping

1-Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	1	3	1	1	1	2
CO 2	2	2	1	3	1	1	1
CO 3	1	2	2	3	1	1	1
CO 4	1	1	2	3	1	1	1
CO 5	1	1	2	3	1	1	1

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Group discussion on different types of cells and their components.

Evaluation method: Identifying the best group or performer and giving a reward.

Unit-2: Activity: Observation of chromosomal aberrations in *Allium cepa* root cells exposed to industrial effluent/ heavy metals

Evaluation method: Validation of report and assigning a grade based on a rubric.

Unit-3: Activity: Solving the problems on classical genetics.

Evaluation method: Assessing the accuracy in solving the problems and awarding a grade.

Unit-4: Activity: Making models of nucleic acids.

Evaluation method: Selecting the best and assigning a grade.

Unit-5: Activity: Making a comprehensive report on sex determination in plants by collecting scientific literature.

Evaluation method: Validation of report and assigning a grade based on a specified point scale.

DR. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. Botany Major - Semester -V : Course-12 Theory Paper (w.e.f. 2023-2024) Paper-12: CELL BIOLOGY AND GENETICS

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 1. Cell theory
- 2. Plastid DNA
- 3. Karyotype
- 4. Nucleosome
- 5. Linkage
- 6. Genetic code
- 7. Concept of Gene
- 8. Gene as unit of function

Section – B

5×8= 40 MARKS

Answer ALL the following Questions, Draw neat and labelled diagrams wherever necessary

1. a) Explain Ultrastructure of cell wall and its chemical constituents?

(Or)

b) Describe Ultrastructure of plasma membrane and the fluid mosaic model?

2. a) Brief account on structural aberrations of chromosomes? (Or)

b) Describe the organisation of DNA in a chromosome using nucleosome and solenoid model?

3. a) Explain Mendel's law of Inheritance?

- b) Explain Chromosomal mapping using 2 point test cross?
- 4. a) Give a brief account on Replication of DNA?

(Or)

- b) Explain Regulation of gene expression with Lac operon?
 - 5. a) Discuss the pattern of sex determination in plants?

b) Explain Hardy-Weinberg law?

DR. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. Botany Major - Semester -V: Course-12 Theory Paper (w.e.f. 2023-2024) Paper-12: CELL BIOLOGY AND GENETICS

Question Bank (Short answer Questions, 4 Marks)

Unit - 1: Cell ant its Organelles

- 10. Cell theory
- 11. Prokaryotic vs Eukaryotic cell
- 12. Cell wall
- 13. Functions of Plasma membrane
- 14. Ultra structure of Chloroplast
- 15. Plastid DNA
- 16. Ultra structure of Mitochondria
- 17. Mitochondrial DNA

Unit – 2: Chromosomes

- 1. Prokaryotic vs Eukaryotic chromosome 6. SAT
- 2. Centromere
- 3. Euchromatin
- 4. Structural chromosomal aberrations
- 5. Aneuploidy

- 7. Karyotype 8. Nucleosome
- 9. Euploidy
- 10. Solenoid model

Unit – 3: Mendelian and non-mendelian Genetics

- 1. Law of segregation
- 2. Law of independent assortment
- 3. Complementary gene interactions 8. Multiple allelism
- 4. Supplementary gene interactions
- 5. Duplicate gene interactions
- 6. Incomplete Dominance
- 7. Co-dominance
- 9. Linkage
- 10. Chromosomal maps
- 11. Maternal inheritance

Unit – 4: Structure and functions of DNA

- 1. Functions of DNA
- 2. Semi conservative DNA replication
- 3. Functions of RNA
- 4. Genetic code
- 5. Lac operon

Unit – 5: Gene concept and Sex determination

- 1. Concept of Gene
- 2. Molecular concept of Gene
- 3. Cis-Trans complementation test
- 4. Gene as unit of function
- 5. Hardy Weinberg law

DR. V.S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. Botany Major - Semester -V: Course-12 Theory Paper (w.e.f. 2023-2024) Paper-12: CELL BIOLOGY AND GENETICS

Question Bank(Essay Questions, 8 Marks)

Unit - 1: Cell ant its Organelles

- 1. Describe the Ultrastructure of a plant cell.
- 2. Ultrastructure of cell wall and its chemical constituents.
- 3. Ultrastructure of plasma membrane and the fluid mosaic model.
- 4. Write an essay on plastid and mitochondrial DNA.

Unit – 2: Chromosomes

- 1. Detailed account on morphology of eukaryotic chromosome.
- 2. Give an account on Euchromatin and Heterochromatin.
- 3. Brief account on structural chromosomal aberrations.
- 4. Brief account on Numerical chromosomal changes.
- 5. Describe the organisation of DNA in a chromosome using nucleosome and solenoid model

Unit - 3: Mendelian and non-mendelian Genetics

- 1. Explain Mendel's laws of Inheritance.
- 2. Describe incomplete dominance and Co-dominance.
- 3. Explain various Gene-interactions with plant examples.
- 4. Explain Linkage and Crossing-over.
- 5. Chromosomal mapping using 2 point and 3 point test cross.

Unit – 4: Structure and functions of DNA

- 1. Describe structure of DNA using Watson and Crick model.
- 2. Give a brief account on Replication of DNA.
- 3. Detailed account on Transcription.
- 4. Detailed account on Translation.
- 5. Types and functions of RNA.
- 6. Regulation of gene expression Lac operon.

Unit – 5: Gene concept and Sex determination

- 1. Explain the Gene concept and its evolution.
- 2. Cis-Trans complementation test for functional allelism.
- 3. Discuss the pattern of sex determination in plants.
- 4. Explain Hardy-Weinberg law.

SEMESTER – IV, COURSE 12: CELL BIOLOGY AND GENETICS Credits -1

I. Laboratory/field exercises:

- 1. Study of ultra structure of plant cell and its organelles using electron microscopic photographs /models.
- 2. Demonstration of mitosis in Allium cepa/Aloe vera roots using squash technique.
- 3. Observation of various stages of mitosis in permanent slides.
- 4. Demonstration of meiosis in P.M.C.s of *Allium cepa* flower buds using squash technique.
- 5. Observation of various stages of meiosis in permanent slides.
- 6. Study of structure of DNA and RNA molecules using models.
- 7. Solving problems on monohybrid, dihybrid, back and test crosses.
- 8. Solving problems on gene interactions (at least one problem for each of the gene interactions in the syllabus).
- 9. Chromosomes mapping using problems of 3- point test cross data.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.	Max. Marks: 50
1. Demonstration of Mitosis by using Allium cepa roots	10 M
2. Genetics problem solution	10 M
3. Spotters (Slides)	$3 \ge 5 = 15 M$
(Ultra structure of Cell/Chloroplast/Mitochondria)	
DNA Model	
4.Chromosome mapping by 2 point test cross	5 M
4. Record + Viva-voce	7 + 3 = 10 M

SEMESTER – V, COURSE13: PLANT PHYSIOLOGY AND METABOLISM Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To understand the concept of Soil-Plant-Atmosphere continuum based on plantwaterrelations.
- 2. To study the anabolic and catabolic processes in plants.
- 3. To understand the role of plant growth regulators on growth, development and flowering.
- **II. Learning Outcomes:** On successful completion of this course, the students will be able to:

On Com	pletion of the course, the students will be able	Knowledge level (Bloom's
	to	Taxonomy)
CO 1	Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.	Level 1 (Knowledge)
CO 2	Explain the role of minerals in plant nutrition and their deficiency symptoms.	Level 2 (Understanding)
CO 3	Interpret the role of enzymes in plant metabolism.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Hypothesise the light reactions and carbon assimilation processes responsible for synthesis offood in plants.	Level 3 (Application) Level 4 (Analysing)
CO 5	Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO6	Evaluate the physiological factors that regulate growth, development and flowering in plants.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER - V, COURSE13: PLANT PHYSIOLOGY AND METABOLISM

III. Syllabus of Theory:

Unit – 1: Plant-Water relations

- 1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.
- 2. Absorption and lateral transport of water; Ascent of sap
- 3. Transpiration: stomata structure and mechanism of stomatal movements (K⁺ ion flux).
- 4. Mechanism of phloem transport; source-sink relationships.

Unit – 2: Mineral nutrition, Enzymes and Respiration 10 Hrs.

- 1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
- 2. Absorption of mineral ions; passive and active processes.
- 3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
- 4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Unit – 3: Photosynthesis and Photorespiration

- 1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red dropand Emerson enhancement effect
- 2. Concept of two photosystems; mechanism of photosynthetic electron transportand evolution of oxygen; photophosphorylation
- 3. Carbon assimilation pathways (C3, C4 and CAM).
- 4. Photorespiration C2 pathway

Unit – 4: Nitrogen and lipid metabolism

- 1. Nitrogen metabolism: Biological nitrogen fixation asymbiotic and symbioticnitrogen fixing organisms. Nitrogenase enzyme system.
- 2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fattyacids.
- 3. Anabolism of triglycerides, β -oxidation of fatty acids, Glyoxylate cycle.

Unit – 5: Plant growth - development

- 1. Growth and Development: Definition, phases and kinetics of growth.
- 2. Physiological effects of Plant Growth Regulators (PGRs) auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
- 3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
- 4. Seed germination and senescence; physiological changes during seed germination.

Additional Inputs:

Unit I: Apoplast and Symplast

Unit II: Factors influencing Enzyme activity

Unit III: Differences between C3 and C4 Plants

Unit IV: Gluconeogenesis

Unit V: Vernalization

t

8 Hrs.

10 Hrs.

9 Hrs.

8Hrs.

IV. Text Books:

- 1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
- 2. Ghosh, A. K., K. Bhattacharya &G. Hait (2011) A Text Book of Botany, VolumeIII, NewCentral Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

- 1. Aravind Kumar & S.S. Purohit (1998) Plant Physiology Fundamentals and Applications, Agro Botanica, Bikaner
- 2. Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd., Publishers, New Delhi
- 3. Hans Mohr & P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd.,New Delhi
- 4. Hans-Walter heldt (2005) Plant Biochemistry, Academic Press, U.S.A.
- 5. Hopkins, W.G. & N.P.A. Huner (2014) Introduction to Plant Physiology, Wiley India Pvt.Ltd., New Delhi
- Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi
- 7. Pandey, S.M. &B.K.Sinha (2006)Plant Physiology, Vikas Publishing House, New Delhi
- 8. Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology, Thomsen & Wadsworth, Austalia&U.S.A
- 9. Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi
- 10. Taiz, L.&E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi.
- 11. Verma, V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi.

CC)-P(ЭM	lap	ping	

11-Low, 2-Moderate, 3-High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	2	-	-	-	2	-	-	2
CO 2	3	2	1	1	-	2	-	-	2
CO 3	2	1	-	-	-	-	-	-	1
CO 4	3	2	-	-	-	3	-	-	2
CO 5	2	1	-	-	-	2	-	-	1
CO 6	2	2	1	-	-	2	-	-	2
CO-PSO Mapping 10-Low, 2-Moderate, 3-High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	1	2	1	2	1	2
CO 2	1	1	2	1	1	1	1
CO 3	1	1	2	1	3	1	1
CO 4	1	1	2	1	3	1	1
CO 5	2	1	1	1	2	1	1
CO 6	1	2	3	1	3	1	2

VI. Suggested activities and evaluation method

Unit-1: Activity: Observe and tabulate the water content of different plant parts and justify theimportance of the water based on the morphological nature.

Evaluation method: Assess the report and assign the grade points based on a rubric.

Unit-2 Activity: Survey report on various inorganic and organic fertilizers available in the localmarkets.

Evaluation method: Assess the record and award the grades on a specified point scale.

Unit-3 Activity: Identify the C4 plants from their locality and make a report.

Evaluation method: Assessing the clarity, organization, and effectiveness of the report'spresentation and communication based on a rubric.

Unit-4 Activity: Group discussion on various Nitrogen fixing microbes.

Evaluation method: Assessing the group members' ability to think critically and analyze thetopic being discussed.

Unit-5 Activity: A critical assignment on photoperiodic responses in plants in their locality.

Evaluation method: Evaluating the logical coherence and reasoning in the assignment.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester -V : Course-13 Theory Paper (w.e.f. 2023-2024) Paper-13: PLANT PHYSIOLOGY AND METABOLISM

Time: 3 Hrs.

Max. Marks: 60

Section - A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labeled diagrams wherever necessary

- 4. Importance of Water to Plant Life
 - 2. Mechanism of Enzyme action
 - 3. Cyclic Photophosphorylation
 - 4. C3 and C4 Plants differences
 - 5. Fermentation.
 - 6. Physiological effects of Gibberellins
 - 7. Sigmoidal curve
 - 8. Types of lipids

Section – B

5×8= 40 MARKS

Answer any FOUR of the following Questions, Draw neat and labeled diagrams wherever necessary

- 9. a) Explain various theories about the mechanism of Ascent of Sap? (Or)
 - b) Describe the mechanism of Opening and closing of Stomata?
- 10. a) What are Macronutrients? Explain their role and deficiency symptoms in Plants?

(Or)

b) Write an essay on Glycolysis?

- 11. a) Explain the mechanism of Photosynthetic carbon reduction in C3 Plants? (Or)
 - b) Write about Photo Respiration and Significance?

12. a) Explain the mechanism of Biological Nitrogen?

(Or)

b) Write about Beta Oxidation?

13. a) Write Physiological effects of Abscissic acid and Brassino steroids?

(Or)

b) What is Photoperiodism and explain the role of Phytochrome in Flowering?

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM

III B.Sc. (Botany) Major - Semester -V : Course-13 Theory Paper (w.e.f. 2023-2024)

Paper-13: PLANT PHYSIOLOGY AND METABOLISM

Question Bank

Short Questions (4 Marks)

Unit – 1: Plant-Water relations

- 1. Importance of water to plant life
- 2. Lateral transport of Water
- 3. Structure of Stomata
- 4. Munch Pressure flow hypothesis

Unit - 2: Mineral nutrition, Enzymes and Respiration

- 1. K+ Ion flux
- 2. Absorption of Ions
- 3. Properties of Enzymes
- 4. Types of Enzymes
- 5. Classification of Enzymes
- 6. Lock and Key Hypothesis
- 7. Oxidative Phosphorylation
- 8. HMP Shunt

12. Anaerobic respiration

Unit - 3: Photosynthesis and Photorespiration

- 1. Photosynthetic pigments
- 2. Absorption and action spectrum
- 3. Red drop
- 4. Emerson Enhancement effect
- 5. PSI&PSII
- 6. CAM
- 7. Difference between C3 and C4 Plants
- 8. Kranz Anatomy

Unit – 4: Nitrogen and lipid metabolism

- 1. Nitrogenase enzyme
- 2. Types of Lipids
- 3. Saturated and Unsaturated Fatty acids
- 4. Gluconeogenesis
- 5. Synthesis of tryglycerids

Unit – 5: Plant growth - development

- 1. Sigmoidal curve 13. Senescence
- 2. Auxins 14. Physiological changes during seed Germination
- 3. Cytokinins
- 4. Gibberellins
- 5. Abscissic acid
- 6. Ethylene
- 7. Brassinosteroids
- 8. Phytochrome
- 9. Role of Phytochrome in Flowering

Essay Questions (8 Marks)

Unit - 1: Plant-Water relations

- 1. Explain the mechanism of Ascent of Sap
- 2. Mechanism of Opening and closing of stomata
- 3. Mechanism of Phloem transport

Unit – 2: Mineral nutrition, Enzymes and Respiration

- 1. What are Macro elements? Explain their role and deficiency symptoms in plants?
- 2. What are Micro elements? Explain their role and deficiency symptoms in plants?
- 3. Explain active absorption of Ions?
- 4. IUB system of Nomenclature of Enzymes?
- 5. Classification of Enzymes?
- 6. Mechanism of Enzyme action?
- 7. Glycolysis or EMP Pathway?
- 8. Krebs Cycle or TCA cycle?
- 9. HMP shunt?

Unit - 3: Photosynthesis and Photorespiration

- 1. Non Cyclic Photophosphorylation?
- 2. Calvin Cycle or PCR Cycle C 3 Cycle ?
- 3. C4 Cycle
- 4. Photorespiration

Unit – 4: Nitrogen and lipid metabolism

- 1. Mechanism of Biological Nitrogen Fixation
- 2. Nitrogenase Enzyme complex?
- 3. Mechanism of Beta Oxidation?
- 4. Glyoxylate cycle?

Unit – 5: Plant growth - development

- 1. Physiological effects of Auxins and Gibberellins?
- 2. Physiological effects of Cytokinins?
- 3. Physiological effects of Abscissic acid?
- 4. Physiological effects of Ethylene?
- 5. Physiological effects of Brassinsteroids?
- 6. Photoperiodism and types of Plants?

SEMESTER – V, COURSE 13: PLANT PHYSIOLOGY AND METABOLISM

Credits -1

I. Laboratory/field exercises:

- 1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo/Tradescantia* leaves.
- 3. Calculation of stomatal index and stomatal frequency of a mesophyte, a hydrophyte and axerophyte.
- 3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer(at least for a dicot and a monocot).
- 4. Effect of temperature on membrane permeability by colorimetric method.
- 5. Study of mineral deficiency symptoms using plant material/photographs.
- 6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzymeconcentration.
- 7. Separation of chloroplast pigments using paper chromatography technique.
- 8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
- 9. Anatomy of C3, C4 and CAM leaves.
- 10. Estimation of protein by biuret method/Lowry method.
- Minor experiments Osmosis, Arc-auxonometer, ascent of sap through xylem,cytoplasmic streaming

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.	Max. Marks: 50		
1. Physiology Experiment-1 (Major Experiment)	10 M		
2. Experiment-2 (Minor Experiment)	5 M		
3. Experiment -3 (Minor Experiment)	5 M		
4. Identify mineral deficiency symptoms	5 M		
5. Anatomy of C4 Plant & Arc Auxanometer	$2 \ge 5 = 10 M$		
6. Record + Viva-voce	10 + 5 = 15 M		

SEMESTER – V, COURSE 14 A: ORGANIC FARMING

Credits -3

I. Learning Objectives: By the end of this course the learner has:

- 1. To know the beneficial aspects of organic farming against chemical farming.
- 2. To gain knowledge about soil fertility, organic pest and disease management strategies.
- 3. To understand the organic certification process, including the standards and regulationsthat govern organic farming practices.

II. Learning Outcomes: Students at the successful completion of the course will be able to:

On Com	pletion of the course, the students will be able	Knowledge level (Bloom's
	to	Taxonomy)
CO 1	Compare and contrast the advantages and disadvantages of conventional and organic farming.	Level 1 (Knowledge) Level 2 (Understanding)
CO 2	Acquire skills on different composting methods.	Level 2 (Understanding)
CO 3	Acquaint with cultural and crop protection practices related to organic farming.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Acquire knowledge on various management practices in organic farming.	Level 3 (Application) Level 4 (Analysing)
CO 5	Discuss about the certification and marketing of organic foods.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO6	Explain the initiatives of government in promoting organic farming	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

SEMESTER - V, COURSE 14 A: ORGANIC FARMING

III. Syllabus of Theory:

UNIT-1: Basic concepts of organic farming 8 Hrs.

1. Organic farming: Definition, ecological social and economic benefits.

- 2. Organic farming and its components; concepts and principles.
- 3. Biodynamic and natural farming approaches; permaculture and LEISA farmingapproaches.
- 4. Sustainable agriculture, key indicators of sustainable agriculture.
- 5. Living soil and healthy plant concepts.

UNIT-2: Organic inputs for soil

8 Hrs.

10 Hrs.

- 1. Vermicompost production technology.
- 2. Organic manures: Farmyard Manure (FYM), enrichment of FYM.
- 3. Compost, methods of composting (Bangalore, Indore, Coimbatore, NADEP methods).
- 4. Green manuring, classification of green manures.
- 5. Classification of organic residues; recycling of organic residues.

UNIT-3: Organic crop management

- 1. Introduction to organic crop management land preparation, planting technic, nutrient management.
- 2. Factors considered for nutrient management; recommended nutrient quantity –blanket, majorproblems; balance sheet method.
- 3. Nutrient composition of some organic resources, right timing of nutrient application.
- 4. Right method of nutrient application, nutrient use efficiency.

UNIT-4: Cultural and crop protection practices 10 Hrs.

- 1. Pre-sowing irrigation; crop rotation, intercropping and mixed cropping.
- 2. Use of tolerant and resistant varieties; manipulation in sowing dates, irrigation/flooding,destruction of volunteer plants.
- 3. Pest and disease management preventive, physical and mechanical methods.
- 4. Organic crop management rice, red gram, groundnut, and tomato.
- 5. Government interventions to promote organic farming: NPOF, NPMSHF, NHM, RKVY,KVK and APEDA.

UNIT-5: Certification and Marketing of Organics 9 Hrs.

- 1. Organic certification process definition, need, aim and scope, requirements to maintaincertification.
- 2. Organic certification process labelling of products, NPOP, organic quality control, standards, accreditation, inspection, and certification.
- 3. Operational structure of organic certification.
- 4. Marketing organic products.

Additional Inputs: Nil

IV. Text Books:

- 1. Vandana Shiva, Poonam Pande and Jitendra Singh, (2004). Principles of Organic Farming -Renewing the Earth's Harvest, Navdanya, New Delhi.
- 2. Sujit Chakrabarty, Sumati Narayan, Farooq Ahmad Khan, (2019). Arts and Science of Organic Farming, Purna Organics
- 3. Thapa, U., and P. Tripathi, (2016). Organic Farming in India, Agrotech Publications, Udaipur
- 4. Peter, V. Fossel, (2007). Organic Farming (Everything You Need to Know), Voyageur Press, USA

V. Reference Books:

- 1. Richard Wiswall (2009), The Organic Farmer's Business Handbook Chelsea GreenPublishing, White River Junction, VT, USA.
- 2. William Lockeretz (2007), Organic Farming: An International History CABI Publishing, Wallingford, UK.
- Ann Larkin Hansen (2010), The Organic Farmer's Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm Storey Publishing, North Adams, MA, USA. Masanobu Fukuoka (1978), The One-Straw Revolution: An Introduction to Natural FarmingRodale Press, Emmaus, PA, USA.
- 4. Gary Zimmer (2000), The Biological Farmer: A Complete Guide to the Sustainable & Profitable Biological System of Farming Acres U.S.A., Austin, TX, USA
- 5. Albert Howard (1947), The Soil and Health: A Study of Organic Agriculture UniversityPress of Kentucky, Lexington, KY, USA.
- 6. Terri Paajanen (2014), The Complete Guide to Organic Livestock Farming AtlanticPublishing Group, Inc., Ocala, FL, USA.

CO-PO Mapping

12-Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2	2	1	1	3	1	2	2
CO 2	2	1	1	-	-	3	2	2	2
CO 3	2	1	1	1	-	2	1	1	1
CO 4	2	2	1	1	-	2	1	-	2
CO 5	2	3	2	2	2	1	2	2	2
CO 6	2	2	1	1	1	2	1	1	2

CO-PSO Mapping 11-Low, 2-Moderate, 3-High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	2	1	1	1	2	1
CO 2	1	1	1	1	1	1	3
CO 3	1	1	2	1	1	1	2
CO 4	1	1	1	1	1	2	3
CO 5	1	1	2	1	1	1	2
CO 6	1	1	2	1	1	1	1

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Group discussion on advantages and disadvantages of organic and in-inorganic farming methods.

Evaluation method: Analyzing the quality and depth of the content discussed, identifying keyideas, arguments, and supporting evidences.

Unit-2: Activity: Internship on preparation of composts and other organic inputs. **Evaluation method:** Performance evaluations, team feedback and competition results.

Unit-3: Activity: Case study report on management practices in organic farming.

Evaluation method: Evaluating the clarity, coherence, and logical structure of the case studyreport.

Unit-4: Activity: Critical written assignment on support from government agencies to promoteorganic farming.

Evaluation method: Evaluating the application of critical thinking skills, such as analysis, evaluation, and interpretation of information or ideas presented in the assignment.

Unit-5: Activity: A survey report on marketing of organic food products.

Evaluation method: Evaluating the appropriateness and effectiveness of the survey design, including the clarity of questions, survey structure, and response options.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester -V : Course-14 A Theory Paper (w.e.f. 2023-2024) Paper-14 A: ORGANIC FARMING

Time: 3 Hrs.

Max. Marks: 60

Section - A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labeled diagrams wherever necessary

5. What is Organic Farming?

- 2. Types of Organic Manures?
- 3. Nutrient Management in Organic Farming?
- 4. Crop Rotation?
- 5. Brief account of Crop Management in Ground Nut?
- 6. KVK
- 7. Inspection and Certification?
- 8. Physical methods of Pest and Disease management?

Section – B

5×8= 40 MARKS

Answer any five of the following Questions, Draw neat and labelled diagrams wherever necessary

- 6. a) Explain the Principles and components of Organic Farming? (Or)
 - b) What is Sustainable Agriculture? Explain key indicators of Sustainable Agriculture?
- 7. a) Write an essay on Vermicompost technology?

(Or)

b) What is Compost? Explain the methods Composting?

- 8. a) Describe the Crop management method? (Or)
 - b) Write about right method of Nutrient application and Nutrient use efficiency?
- 9. a) Explain the Organic Crop management in Rice crop? (Or)

b) Write an essay on intercropping and mixed cropping?

10. a) What is Organic Certification? Explain its need, scope and requirements?

(Or)

b) Write an essay on Marketing of Organic products?

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Question Bank

Short Questions (4 Marks)

UNIT-1: Basic concepts of organic farming

- 1. Concept of Organic farming
- 2. Ecological benefits of organic farming
- 3. Economic benefits of organic farming
- 4. Components of organic farming
- 5. Principles of organic farming
- 6. Perrma culture
- 7. LEISA farming approach
- 8. Key indicators of Sustainable agriculture
- 9. Concept of living soil
- 10. Concept of healthy plant

UNIT-2: Organic inputs for soil

- 1. Farm Yard manure
- 2. Compost
- 3. Methods of composting
- 4. Classification of green manures
- 5. Recycling of organic Residues

UNIT-3: Organic crop management

- 1. Nutrient management in organic farming
- 2. Nutrient composition in organic manures
- 3. Nutrient use efficiency

UNIT-4: Cultural and crop protection practices

- 1 Crop rotation
- 2. Intercropping
- 3. Mixed cropping
- 4. KVK
- 5. APEDA

UNIT-5: Certification and Marketing of Organics

- 1. Labelling of products
- 2. Organic quality control
- 3. Organic certification process
- 4. Marketing of Organic products

Essay Questions (8 Marks)

UNIT-1: Basic concepts of organic farming

- 1. What is Organic farming? Explain its ecological social and economic benefits?
- 2. What are the principles and Components of Organic Farming?
- 3. Write an account of Sustainable Agriculture?

UNIT-2: Organic inputs for soil

- 1. Write about Vermicompost production technology?
- 2. Explain about Farmyard Manure (FYM) and enrichment of FYM.
- 3. What is Composting? Explain methods of composting?
- 4. What are Green manures? Give classification of green manures?

UNIT-3: Organic crop management

- 1. Write an essay on Organic crop management?
- 2. Explain Nutrient composition of some organic resources and right timing of nutrient application?
- 3. Write an account of Right method of nutrient application and nutrient use efficiency?

UNIT-4: Cultural and crop protection practices

- 6. Explain about Crop rotation and intercropping?
- 7. Write an account of physical and mechanical methods of Pest and disease management?
- 8. Explain Organic Crop management in Ground Nut?

UNIT-5: Certification and Marketing of Organics

- 1. What is Organic certification process? Explain its aim and scope, requirements to maintain certification?
- 2. Explain Organic quality control, standards, accreditation, inspection, and certification?
- 3. Write about Marketing of organic products?

Semester – V, Course 14 A: Organic Farming

Credits -1

I. Laboratory/field exercises:

- 1. Preparation of Jeevamrutham (liquid and solid) and Beejamrutham.
- 2. Preparation of Neemastram and Brahmastram.
- 3. Preparation of Agniastram and Dashaparni Kashayam.
- 4. Study of intercropping method.
- 5. Study of water management in Organic Farming.
- 6. Study of livestock component in Organic Farming.
- 7. Hands on training on vermicompost preparation.
- 8. Study of different organic and green manures.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs. 50

Max. Marks:

1. Experiment-1 (Major Experiment)				
(Preparation of Jeevamrutam)				
2. Experiment-2 (Minor Experiment) (Preparation of Neemastram)	5 M			
3. Preparation of Brahmastram	5 M			
4. Preparation of Vermicompost	10 M			
5. Study of Organic and Green Manures	10 M			
6. Record + Viva-voce $7 + 3 =$	10 M			

SEMESTER – V, COURSE 15 A: MUSHROOM CULTURE TECHNOLOGY

Credits -3

Learning Objectives: By the end of this course the learner has:

1. To learn about the morphology and nutritional value of some edible mushrooms.

2. To gain knowledge on basic requirements for establishing a mushroom culture unit.

3.To learn the cultivation methods and management practices specific to certain ediblemushrooms.

Learning Outcomes: Students at the successful completion of the course will be able to:

On Co	mpletion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Understand the structure and life of a mushroom and discriminate edible and poisonousmushrooms.	Level 1(Knowledge) Level 2 (Understanding)
CO 2	Identify the basic infrastructure to establish a mushroom culture unit.	Level 1 (Knowledge) Level 2 (Understanding)
CO 3	Demonstrate skills preparation of compost and spawn.	Level 1 (Knowledge) Level 2 (Understanding)
CO 4	Acquire a critical knowledge on cultivation of some edible mushrooms.	Level 3 (Application) Level 4 (Analysing)
CO 5	Explain the methods of storage, preparation of value-added products and marketing.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

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SEMESTER - V, COURSE 15 A: MUSHROOM CULTURE TECHNOLOGY 12. Syllabus of Theory:

Unit – 1: Introduction and value of mushrooms 8 Hrs.

- 1. Mushrooms: Definition, structure of a mushroom and a brief account of life cycle; historical account and scope of mushroom cultivation; difference between edible and poisonous mushrooms.
- 3. Morphological features of edible mushrooms Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajor-caju) and Paddy straw mushroom (Volvariella volvacea).
- 4. Nutraceutical value of mushrooms; medicinal mushrooms in South India (Ganoderma lucidum, Phellinus rimosus, Pleurotus florida and Pleurotus pulmonaris) and their therapeutic value; Poisonous mushrooms - harmful effects.

Unit – 2: Basic requirements of cultivation system

- 1. Small village unit and larger commercial unit; layout of a mushroom farm location of building plot, design of farm, bulk chamber, composting, equipment and facilities, pasteurization room and growing rooms.
- 2. Compost and composting: Definition, machinery required for compost making, materials forcompost preparation.
- 3. Methods of composting- long method of composting and short method of composting.

Unit – 3: Spawning and casing

- 1. Spawn and spawning: Definition, facilities required for spawn preparation; preparation of spawn substrate.
- 2. Preparation of pure culture, media used in raising pure culture; culture maintenance, storage ofspawn.
- 3. Casing: Definition, Importance of casing mixture, Quality parameters of casing soil, differenttypes of casing mixtures, commonly used materials.

Unit – 4: Mushroom cultivation

Raw material, compost, spawning, casing, cropping, and problems in cultivation (diseases, pests and nematodes, weed molds and their management strategies), picking and packing of the following mushrooms:

(a) Button mushroom (b) Oyster mushroom (c) Milky mushroom and (d) Paddy straw mushroom

10 Hrs.

10 Hrs.

9 Hrs.

Unit – 5: Post harvest technology

8 Hrs.

- 1. Shelf life of mushrooms; preservation of mushrooms freezing, dry freezing, drying andcanning.
- Quality assurance and entrepreneurship economics of different types of mushrooms; valueadded products of mushrooms.
- 3. Management of spent substrates and waste disposal of various mushrooms.

Additional Inputs:

Unit V: Marketing of Mushrooms

13. Text Books:

- a. Tavis Lynch (2020) Mushroom Cultivation: An Illustrated Guide to Growing Your OwnMushrooms at Home, Rockridge Press, Emeryville, California, USA
- b. Chang, P. and C. P. Bhatnagar (2003) Mushrooms: Cultivation, Nutritional Value, MedicinalEffect, and Environmental Impact, CRC Press, Boca Raton, Florida, USA
- c. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, NewDelhi.
- d. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.

14. Reference Books:

- a. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
- b. Pandey R.K, S. K Ghosh, (1996). A Hand Book on Mushroom Cultivation. EmkeyPublications
- c. Nita Bhal. (2000). Handbook on Mushrooms (Vol. I and II). Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi
- d. Pathak V.N., Nagendra Yadav and Maneesha Gaur (2000), Mushroom Production andProcessing Technology Vedams Ebooks Pvt. Ltd., New Delhi
- Rattan, S.S. and R.C. Upadhyay (2006) Mushroom Production Technology: RecentAdvances, Daya Publishing House, Delhi, India

CO-PO Mapping

13-Low, 2-Moderate, 3-High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2	1	-	-	1	1	1	2
CO 2	2	1	1	-	-	1	3	3	3
CO 3	3	1	1	-	1	2	2	2	2
CO 4	3	2	2	2	1	2	3	3	3
CO 5	2	1	1	1	1	2	3	3	3

CO-PSO Mapping

12-Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	1	1	2	1	1	3	3
CO 2	1	1	1	1	1	3	2
CO 3	1	1	2	1	1	2	2
CO 4	1	1	2	1	1	2	3
CO 5	1	1	2	1	1	3	3

15. Suggested activities and evaluation methods:

Unit-1: Activity: Collection of data on various types of mushrooms and making a report. **Evaluation method:** Judging the written report, providing feedback on the overall quality, strengths, and areas for improvement.

Unit-2: Activity: Group discussion of mushroom cultivation units and layout.

Evaluation method: Members of the group provide evaluations of their peers' contributions and participation.

Unit-3: Activity: Internship on spawning and casing in mushroom culture.

Evaluation method: A viva-voce at the end of internship based on specific performance metrics and knowledge gained.

Unit-4: Activity: Case study on production techniques for different edible mushrooms. **Evaluation method:** Clarity, coherence, and logical structure of the case study report based onidentification of key issues, analysis, and synthesis of information.

Unit-5: Activity: A survey report on market demand and consumer preferences for mushroomsand their value-added products.

Evaluation method: Assessing the quality of data analysis, including the use of appropriate statistical techniques, interpretation of results, and meaningful conclusions.

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester -V : Course-15 Theory Paper (w.e.f. 2023-2024)

Paper-15: Course 15 A: Mushroom Culture Technology

Time: 3 Hrs.

Max. Marks: 60

Section – A

5×4 =20 MARKS

Write any FIVE of the following questions, Draw neat and labelled diagrams wherever necessary

- 1. Differences between edible and poisonous mushrooms
- 2. Button mushroom
- 3. Nutraceutical values of Mushrooms
- 4. Layout of mushroom farm
- 5. Storage of Spawn
- 6. Problems in mushroom cultivation
- 7. Value added products of Mushrooms
- 8. Medicinal mushrooms of South India

Section – B

5×8= 40 MARKS

Answer any Five of the following Questions, Draw neat and labelled diagrams wherever necessary

9. a) Write structure and life cycle of Mushroom?

(Or)

- b) Describe morphological features of oyster mushroom?
- 10. a) Describe the layout of commercial mushroom unit?

(Or)

b) What is compost and composting? Explain the machinery required for compost making and materials required for compost preparation?

11. a) What is spawning? Explain the facilities required for spawn preparation? (Or)

b) What is the casing? Write importance of casing mixture?

- 12 a) Explain the method of cultivation in Milky mushroom? (Or)
 - b) Explain the cultivation method of paddy straw Mushroom?

13.a) Describe different preservation methods of Mushrooms?

(Or)

b) Write an account on management of a spent substrates and waste disposal of a various mushrooms?

DR. V.S. KRISHNA GOVT. DEGREE GOVERNMENT DEGREE COLLEGE (A), VISAKHAPATNAM III B.Sc. (Botany) Major - Semester -V : Course-15 Theory Paper

(w.e.f. 2023-2024)

Paper-15: Course 15 A: Mushroom Culture Technology

Question Bank Short Questions (4 Marks)

Unit - 1: Introduction and value of mushrooms

- 1. Structure of Mushroom
- 2. Brief account of life cycle in mushroom
- 3. Differences between edible and poisonous mushrooms
- 4. Morphology of button mushroom
- 5. Nutraceutical value of Mushrooms
- 6. Medicinal mushrooms in South India
- 7. Harmful effects of poisonous mushrooms

Unit – 2: Basic requirements of cultivation system

- 1. Layout of mushroom farm
- 2. Pasteurization
- 3. Materials for compost preparation
- 4. Methods of composting

Unit – 3: Spawning and casing

- 1. Spawn
- 2. Preparation of pure culture
- 3. Storage of spawn
- 4. Importance of casing mixture
- 5. Casing material

Unit – 4: Mushroom cultivation

1. Problems in Mushroom cultivation

2.Packing of Mushrooms

Unit – 5: Post harvest technology

- 1. Preservation of Mushrooms
- 2. Canning
- 3. Value added products of Mushrooms

Essay Questions (8 Marks)

Unit - 1: Introduction and value of mushrooms

- 1. Describe structure and life cycle of Mushroom?
- 2. Write about historical account and scope of mushroom cultivation?
- 3. Describe morphological features of button mushroom?
- 4. Describe morphological features of oyster mushroom?
- 5. Write nutraceutical and Therapeutic values of Mushrooms?

Unit – 2: Basic requirements of cultivation system

- 1. Describe the layout of commercial mushroom unit?
- 2. What is compost and explain machinery required for composed making?
- 3. Write an essay on methods of composting?

Unit – 3: Spawning and casing

- 1. What is spawning and explain facilities required for spawn preparation?
- 2. What is the casing and explain its importance?
- 3. Explain different types of casing mixtures?

Unit – 4: Mushroom cultivation

- 1. Explain the method of cultivation in Milky mushroom?
- 2. Explain the cultivation method of paddy straw Mushroom?
- 3. Explain the cultivation method of Oyster Mushroom?

Unit – 5: Post harvest technology

- 1. Describe different preservative methods of Mushrooms?
- 2. Write an account of quality assurance and entrepreneurship in mushroom cultivation?

SEMESTER - V, COURSE 15 A: MUSHROOM CULTURE TECHNOLOGY

Credits -1

I. Laboratory/field exercises:

- 1. Identification of different types of mushrooms.
- 2. Preparation of pure culture of an edible mushroom.
- 3. Preparation of mother spawn.
- 4. Production of planting spawn and storage.
- 5. Preparation of compost and casing mixture.
- 6. Demonstration of spawning and casing.
- 7. Hands on experience on cropping and harvesting.
- 8. Demonstration of storage methods.
- 9. Preparation of value-added products.

Suggested Model Paper for Practical Examination

Common pattern for Question Paper for Practical Examination(s) at Semester end

Max Time: 3 Hrs.

Max. Marks: 50

1.Preparation of Mother Spawn	10 M
2. Preparation of Compost and casing mixture	10 M
3. Storage methods of Mushroom	10 M
4. Identify 2 Mushrooms	2X5 = 10 M
5. Record + Viva-voce	7 + 3 = 10 M

Total: 50 Marks