BOARD OF STUDIES
IN
B.Sc BOTANY

2025-2026

DEPARTMENT OF BOTANY

SYLLABUS FOR
B.Sc BOTANY HONOURS

PITHAPUR RAJAH'S GOVERNMENT COLLEGE

Autonomous and Accredited with 'A' Grade by NAAC (3.17 CGPA)
KAKINADA – 533 001, E G Dist., ANDHRA PRADESH

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMpOUS), KAKINADA

Department of Botany

The Board of Studies meeting for **Botany** subject during the academic year **2025-2026** is conducted at the Department of Botany on 07-08-2025 with Dr.Ch. John Samuel, Lecturer in-Charge in the chair along with the following members

Name, Designation and Address	Signature

1.Chair Person:

Dr. Ch. JOHN SAMEL
Lecturer in-charge
Dept. of BOTANY
P.R.G.C.(A), Kakinada
Mobile: 7382525604
E-mail:- drjohnsamuel@gmail.com

2.AdiKavi Nannaya University Nominee:

Dr. J. SUNITHA,
Principal, GDC, Kovvur
Mobile: 9441050910
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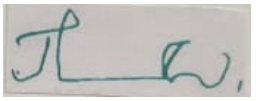

3.Members Nominated by Executive Council of the College:

A. <u>Subject Expert 1:</u>

Dr. G.JYOTHIRMAYEE
Lecturer in Botany
S.R.V.B.S.J.B M.R College,Peddapuram
Mobile: 7989171117
E-mail: drgjbotanymr@gmail.com

B. <u>Subject Expert 2:</u>

Dr.K.USHA SRI
Lecturer in Botany
GDC, Pithapuram.
Mobile:-9441158594
E-mail:- myduushasri@gmail.com

Name, Designation and Address **Signature**

C. Member from Research Organization:

Smt. P. SWATHI
Assistant Director,
Biological Control LaboratoryDept. of Agriculture,
Kakinada
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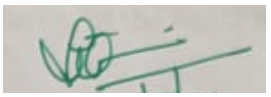
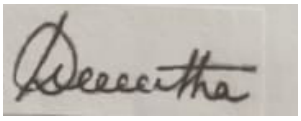


Alumni Member:

Dr. D R SALOMI SUNEETHA
Professor & Head Biochemistry &
College of Horticulture
Chintalataripi
SPSR Nellore District.
Mobile: 9491608088
Email: salomibiochem@gmail.com



1.Members from the College:

A. Faculty Members:

1.Dr. M.KRISHNA RAO
Lecturer in Botany
PRGC(A), Kakinada

B. Student Members

1.N.Abhitha - III Hons Botany

2.B.A.N.V.D.Savithri - III Hons Botany

3. N.Meghana - II Hons Botany

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

DEPARTMENT OF BOTANY

Programme: B. Sc Botany honours

Objectives

1. To create Awareness on all cryptogams
2. To enhance the knowledge about diversity in all cryptogams
3. To create awareness on economic importance of Algae, Fungi, Bryophyta, Pteridophyta
4. To study about Structure and diseases and control methods of plant diseases caused by viruses, bacteria
5. To study about anatomy of plant tissues
6. To study about anomalous secondary growth in different plants
7. To create awareness on classification on flowering plants
8. To study about morphology and floral characters of some flowering plants
9. To know the importance of flowering plants around the habitat
10. To increase the ability of analysis of plant species with classification
11. To create awareness on economic importance of flowering plants
12. To study about the plant embryo formation and development
13. To study about development of plant from embryo
14. To study about the growth and development of plant
15. To Study and observation of absorption of water through roots
16. To enhance the knowledge by observation of osmosis, diffusion
17. To study of Metabolism like photosynthesis, respiration
18. To study about Ecology, population, Community
19. To study about cell biology, genetics
20. To study about geographical distribution of plants
21. To study about medicinal values of different plants

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF BOTANY

Program Outcomes (PO):

- PO1.**Critical Thinking**: 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**: 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**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO4. **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO5. **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.
- PO6. **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes
- PO7.**SKILL DEVELOPMENT**: Acquire the knowledge of practical ability in handling apparatus and process of methodology

Program Specific Outcomes (PSO):-

- PSO1. Understand the nature and basic concepts of Cell biology, Biochemistry, Taxonomy and ecology.
- PSO2. Analyze the relationships among animals, plants and microbes
- PSO3. Perform procedures as per laboratory standards in the areas of Physiology, Genetics, Taxonomy, Anatomy, Embryology, Ecology, Tissue culture & Mushroom cultivation.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF BOTANY
COURSE OUTCOMES

SEMESTER - 1

CO1: Explain the origin, diversity, structure, and multiplication of microbes and thallophytes, including viruses, bacteria, algae, fungi, and lichens, highlighting their unique features and classification systems.

CO2: Explain the origin, diversity, structure, and multiplication of microbes and thallophytes, including viruses, bacteria, algae, fungi, and lichens, highlighting their unique features and classification systems.

CO3: Analyze the economic importance of microbes and thallophytes by identifying their beneficial and harmful roles in agriculture, industry, medicine, food, and environmental sustainability.

CO4: Develop practical skills in microbiological and phycological techniques, such as aseptic handling, staining, cultivation, and microscopic identification of microorganisms, algae, fungi, and lichens.

CO5: Integrate theoretical and experimental knowledge to evaluate the applications of microorganisms and thallophytes in biotechnological fields such as biofertilizers, biopesticides, fermentation, and production of metabolites and bioactive compounds.

SEMESTER – 2

CO1: Compare and contrast the morphological, anatomical and reproductive features of Bryophytes, Pteridophytes and Gymnosperms.

CO2: Illustrate the evolutionary trends in Pteridophytes and Gymnosperms highlighting vasculature, heterospory and seed habit.

CO3: Analyze the ecological and economic importance of Bryophytes, Pteridophytes and Gymnosperms.

CO4: Develop practical skills in microscopic observation, slide preparation and identification of Archegoniate plant groups.

CO5: Integrate theoretical and practical knowledge to evaluate the structural diversity and evolutionary significance of Archegoniate plants.

SEMESTER – 3

CO1: Describe the diversity, reproduction, and evolution of major plant groups including Pteridophytes, Gymnosperms, Angiosperms, and pathogens.

CO2: Apply taxonomic tools and botanical evidence to identify, classify, and understand plant species and their relationships.

CO3: Explain plant diseases and recommend appropriate control and management practices for various crops.

CO4: Propose suitable breeding and pollination methods for developing hybrid and improved crop varieties.

CO5: Demonstrate plant tissue culture and biotechnology skills and evaluate their applications in agriculture, environment, and industry.

SEMESTER – 4

CO1: Describe plant tissues, reproductive processes, and embryogenesis in relation to plant growth and development.

CO2: Explain anomalous secondary growth and assess the significance of timber and anatomical adaptations in plants.

CO3: Discuss ecosystem dynamics, population and community structure, and the impacts of climate change.

CO4: Evaluate biodiversity, propose conservation strategies, and conduct field surveys on plant distribution.

CO5: Identify and appraise the nutritional, medicinal, aromatic, timber, and commercial uses of plant products.

SEMESTER – 5

CO1: Explain the structure and functions of plant cells, chromosomes, nucleic acids, and gene inheritance.

CO2: Interpret physiological and biochemical processes in plants including water transport, mineral nutrition, metabolism, and growth regulation.

CO3: Describe seed dormancy, processing, testing, storage, and certification procedures along with seed pathology management.

CO4: Demonstrate knowledge and skills in mushroom biology, composting, cultivation, and value-added product preparation.

CO5: Apply scientific principles to evaluate plant-based biotechnological, physiological, and agricultural practices.

S. No.	Semester	Title of the Course(Paper)	Hours /week	Max. Marks (SEE)	Marks in CIA	Credits
1.	Sem.-I/ Course-1-major	Diversity of Microbes	03	50	50	03
	Sem.-I/ Course-1-major practical	Diversity of Microbes	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem.-I/ Course-2-major	Diversity of Thallophytes	03	50	50	03
	Sem.-I/ Course-2-major practical	Diversity of Thallophytes	02	Max. Marks-50 Internal assessment at Semester end		01
2.	Sem.-II/ Course-3-major/ Minor	Diversity of Archegoniates	03	50	50	03
	Course-3 Major/ Minor practical	Diversity of Archegoniates	02	Max. Marks-50 Internal assessment at Semester end		01
	Sem.-II/ Course-4-major	Anatomy and Embryology of Angiosperms	03	50	50	03
	Course-4 major practical	Anatomy and Embryology of Angiosperms	02	Max. Marks- 50 Internal assessment at Semester end		01
3.	Sem -III Course-5 Major/ minor	Vascular Plants	03	50	50	03
	Sem -III Course-5 Major/ minor practical	Vascular Plants	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -III Course-6 Major	Plant Pathology and Plant Diseases	03	50	50	03
	Sem -III Course-6 Major/practical	Plant Pathology and Plant Diseases	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -III Course-7 Major	Plant Breeding	03	50	50	03
	Sem -III Course-7 Major practical	Plant Breeding	02	Max. Marks- 50 Internal assessment at Semester end		01

	Sem -III Course-8 Major	Plant Biotechnology	03	50	50	03
	Sem -III Course-8 Major/practical	Plant Biotechnology	02	Max. Marks- 50 Internal assessment at Semester end		01
4	Sem -IV Course-9 Major/Minor	Anatomy and Embryology of Angiosperms	03	50	50	03
	Sem -IV Course-9 Major/Minor practical	Anatomy and Embryology of Angiosperms	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -IV Course-10 Major/Minor	Plant Ecology, Biodiversity and Phytogeography	03	50	50	03
	Sem -IV Course-10 Major/Minor practical	Plant Ecology, Biodiversity and Phytogeography	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -IV Course-11 Major	Plant Resources and Utilization	03	50	50	03
	Sem -IV Course-11 Major practical	Plant Resources and Utilization	02	Max. Marks- 50 Internal assessment at Semester end		01
5	Sem -V Course-12 Major/ Minor	Cell Biology and Genetics	03	50	50	03
	Sem -V Course-12 Major/ Minor practical	Cell Biology and Genetics	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -V Course-13 Major/ Minor	Plant Physiology and Metabolism	03	50	50	03
	Sem -V Course-13 Major/ Minor practical	Plant Physiology and Metabolism	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -V Course-14 Major	Seed Technology	03	50	50	03
	Sem -V Course-14 Major practical	Seed Technology	02	Max. Marks 50 Internal assessment at Semester end		01

	Sem -V Course-15 Major	Mushroom Cultivation	03	50	50	03
	Sem -V Course-15 Major practical	Mushroom Cultivation	02	Max. Marks 50 Internal assessment at Semester end		01
6	SEM VI	**LONG TERM INTERNSHIP (APPRENTICESHIP)**				

PITHAPUR RAJAH'S GOVERNMENT COLLEGE [A]:: KAKINADA
PLAN OF ACTION FOR AY 2025-26

DEPARTMENT:BOTANY

S.No	Activity planned	Dates/ Period
1	National/International Conference	August-2025
2	Monthly Examinations on competitive examination lines	Monthly
3	Certificate course-2 (CONDUCT ATLEAST ONE IN THE ACADEMIC YEAR)	August-2025
4	Guest Lectures - 4	September, October & November-2025
5	Workshop	October/ November-2025
6	MoUs - 3 (Target)	In 2025-26
7	Research publications - 5 (target)	2025-26
8	Community Outreach programs: (I Programme is mandatory in the semester)	One in each Semester
11	Plantation of saplings in Adopted village	December-2025
12	Best Practices	Continuation of Plant of the Day, Organic Farming
13	Field trip	August -2025 and February-2026

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF BOTANY

BOTANY COURSE STRUCTURE AND SYLLABUS

Botany Model Blue Print for the Question paper and choice for I, II & III Years (w.e.f. 2025 - 26 Academic Year)

S.No	Type of Questions	To be given in the Question paper			To be Answered		
		No. of Questions	Marks Allotted to each Question	Total marks	No. of Questions	Marks Allotted to each Question	Total marks
1	SECTION-A ESSAY QUESTIONS (EQ)	6	10	60	3	10	30
2	SECTION-B SHORT ANSWER QUESTIONS (SAQ)	7	5	35	4	5	20
Total Questions & Total Marks =		**13**	**-**	**95**	**7**	**-**	**50**

$$\textbf{Percentage of choice given} = \frac{95 - 50}{100} \times 100 = \frac{45}{100} \times 100 = 45$$

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany- I Semester (W.E.F. 2025-26)
Major

Course 1 : Diversity of microbes

Credits -3

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

1. Gain awareness on hypotheses about the origin of life on Earth, and structure and multiplication of viruses.
2. Identify and describe the unique characteristics and significance of special types of bacteria.
3. Describe the structure, classification, and reproductive methods of eubacteria.
4. Tell the types of soil microorganisms and explain their interactions with each other, plants, and soil components.
5. Identify and differentiate between beneficial and harmful activities microbes in different fields.

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

1. Illustrate the origin of life on Earth and diversity, multiplication and economic value of viruses.
2. Deliberate the general characteristics, and economic importance of special groups of bacteria.
3. Explain the structure, nutrition, reproduction and significance of eubacteria.
4. Evaluate the interactions of soil microbes among themselves and with plants.
5. Compile the value and applications of microbes in various fields.

III. Syllabus of Theory:

Unit-1: Origin of life and Viruses 10 Hrs.

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment.; discovery of microorganisms, Pasteur experiments, germ theory of diseases; three domain – six kingdom classification of Carl Woese.
2. Shape and symmetry of viruses; structure of TMV and Gemini virus.
3. Lytic and lysogenic cycles of T-even phages; a brief account of prions, viroids and virusoids.
4. Transmission of plant viruses and their control; significance of viruses in production of vaccines and bio-pesticides.

Unit-2: Special groups of Bacteria 7 Hrs.

1. General characteristics, and economic importance of following special groups of bacteria:

a) Archaebacteria b) Actinomycetes c) Phytoplasma d) Cyanobacteria

2. Culture and cultivation of *Spirulina*

Unit-3: Eubacteria 8 Hrs.

1. Occurrence, distribution and cell structure of eubacteria; classification of Eubacteria based on nutrition
2. Reproduction- asexual (binary fission and endospores) and bacterial recombination (conjugation, transformation, and transduction).
3. Economic importance of Eu-bacteria with reference to their role in Agriculture and industry (fermentation and medicine).

Unit-4: Soil microbes – interactions 10Hrs.

1. Distribution of microorganisms in soil; factors influencing the soil microflora; role of microorganisms in soil fertility.
2. Microbial interactions: symbiosis, neutralism, commensalism, competition, antagonism, synergism, parasitism and predation.
3. Microorganisms of rhizosphere, phyllosphere and spermosphere; microbial interactions and their effect on plant growth.

Unit-5: Beneficial and harmful microbes 10 Hrs.

1. A brief account of symptoms of viral diseases in plants; Tungro disease in paddy.
2. A summary of symptoms of bacterial diseases in plants; Citrus canker.
3. Microorganisms as food; probiotics and prebiotics; products from microorganisms, Metabolites, enzymes, and antibiotics.
4. Bacterial and Cyanobacterial biofertilizers – their applications; Bacterial biopesticides and their applications.

IV. Text Books:

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

V. Reference Books:

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

VI. 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: Visit to Agriculture/Horticulture universities to learn about biofertilizers and biopesticides.

Evaluation method: Evaluating the report submitted by the student based a rubric.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany- I Semester (W.E.F. 2025-26)
Major

Course 1 : Diversity of microbes

Practical | 02 hours /Week | Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Take all necessary precautions in the microbiology laboratory.
2. Handle the instruments and prepare media for laboratory work.
3. Identify various microbes through microscopic observations.

II. Laboratory/Field exercises:

1. 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.
2. Study of Viruses (TMV and Gemini) using electron micrographs/ models.
3. Microscopic study of Cyanobacteria using temporary/permanent slides.
4. Study of Archaebacteria, Actinomycetes and Phytoplasma using permanent slides/ electron micrographs/diagrams.
5. Microscopic study of Eubacteria using temporary/permanent slides.
6. Gram staining technique of Bacteria.
7. Demonstration of culture and cultivation of *Spirulina*
8. Tungro in Paddy and Citrus canker.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Year B.Sc. HONOURS BOTANY
Practical Examinations at I Semester End (2025-26)
Model Paper
Major

Course 1 : Diversity of microbes

Time: 2 Hrs. **Max. Marks: 50**

1.Demonstrate the gram staining technique in bacteria **10m**

2.Identify the given material A (Cyanobacteria) and draw the diagram, justify the characters **10m**

3. Identify the given material B (Eubacteria) and draw the diagram, justify the characters **10m**

4. Identify the given Spotters and justify the characters **3 X 4 = 12m**

C-Laboratory equipment

D-virus (Gemini/TMV)

E- Bacterial disease / Viral disease

5.Record + Viva Voce **5 + 3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany / I Semester (W.E.F. 2025-26)
Major

Course 1 : Diversity of microbes

QUESTION BANK

Unit-1: Origin of life and Viruses

Essay Questions

1. Describe the salient features of six kingdom classification.
2. Explain various methods of plant virus transmission.
3. Describe the significance of Viruses in Vaccine Production.
4. Write about Miller and Urey experiment.
5. Describe lytic and lysogenic cycles in T even phases.

Short Answer Questions

1. Shapes of Viruses.
2. Structure of Gemini Virus.
3. Structure of TMV.
4. Prions.
5. Viroids & Virusoids.
6. Germ theory of Diseases.

Unit-2: Special Groups of Bacteria

Essay Questions

1. Describe the general characteristic feature of Actinomycetes.
2. Describe the general characteristic features of Archaebacteria.
3. Describe the general characteristic features of Cyanobacteria.

Short Answer Questions

1. Phytoplasmas.
2. Economic importance of Cyanobacteria.
3. Cultivation of Spirulina.

Unit-3: Eubacteria

Essay Questions

1. Classify Eubacteria based on Nutrition.
2. Describe the structure of a Bacterial cell.

3. Describe the process of conjugation in Bacteria.

Short Answer Questions

1. Explain role of Bacteria in Agriculture.
2. Explain role of Bacteria in Industry.
3. Explain role of Bacteria in Medicine.
4. Structure of Endospore.
5. Binary fission in Bacteria.

Unit-4: Soil Microbes - Interactions

Essay Questions

1. Describe the role of Microorganisms in Soil Fertility.
2. Explain various factors Influencing the Soil Microflora.
3. Give an account of various microbial interactions.

Short Answer Questions

1. Microorganisms of the Rhizosphere.
2. Microorganisms of the Phyllosphere.
3. Microorganisms of the Spermosphere.

Unit-5: Beneficial and Harmful Microbes

Essay Questions

1. Give a brief account of the symptoms of viral diseases in plants.
2. Give a brief account of symptoms of Bacterial Diseases in Plants.
3. Give an account of microbial metabolites, enzymes, and antibiotics.

Short Answer Questions

1. Tungro Disease of Paddy.
2. Citrus Canker.
3. Microorganisms as food.
4. Probiotics and prebiotics.
5. Cyanobacterial biofertilizers.
6. Bacterial Biofertilizers and their applications.
7. Give an account of Bacterial Biopesticides and their applications.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany / I Semester (W.E.F. 2025-26)
Major

Course 1 : Diversity of microbes

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

1. Describe the significance of Viruses in Vaccine Production.
2. Describe the general characteristic features of Archaebacteria.
3. Describe the structure of a Bacterial cell.

SECTION -B

4. Describe the role of Microorganisms in Soil Fertility.
5. Give a brief account of symptoms of Bacterial Diseases in Plants.
6. Write about Miller and Urey experiment.

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

7. Structure of TMV.
8. Economic importance of Cyanobacteria.
9. Structure of Endospore.
10. Microorganisms of the Phyllosphere.
11. Probiotics and prebiotics.
12. Germ theory of Diseases.
13. Citrus Canker.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany / I Semester (W.E.F. 2025-26)
Major

Course 1 : Diversity of microbes

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
Unit-1: Origin of life and Viruses	2	2	30
Unit-2: Special Groups of Bacteria	1	1	15
Unit-3: Eubacteria	1	1	15
Unit-4: Soil Microbes - Interactions	1	1	15
Unit-5: Beneficial and Harmful Microbes	1	2	20

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany- I Semester (W.E.F. 2025-26)
Major

COURSE 2: DIVERSITY OF THALLOPHYTES

Credits -3

I. Learning Objectives: By the end of this course the learner has to:
1. Brief the general characters, classification and value of algae.
2. Discuss the morphology, reproduction and life cycles of some algae.
3. Tell the general characters, classification and value of fungi.
4. Discuss the morphology, reproduction and life cycles of some fungi.
5. Summarize the morphology, anatomy, reproduction and economic value of lichens.

II. Course Outcomes: On completion of this course students will be able to:
1. Compile the general characteristics of algae and their significance in nature.
2. Compare and contrast the characteristics of different groups of algae.
3. Summarize the important features of fungi and their economic value.
4. Distinguish different groups of fungi based on their characteristics.
5. Elaborate the features and significance of lichens.

III. Syllabus of Theory:

Unit-1: Introduction to Algae — 8Hrs.

1. General characteristics of algae: occurrence and distribution, cell structure, pigments, flagella and reserve food material.
2. F.E.Fritsch (1935) classification of algae; thallus organization in algae.
3. Life cycles in algae; ecological and economic importance of algae.

Unit-2: Biology of selected Algae — 10Hrs.

1. Occurrence, structure, reproduction and life cycle of:
   (a) Chlorophyceae: *Spirogyra* (b) Phaeophyceae: *Ectocarpus* and (c) Rhodophyceae: *Polysiphonia*
2. Culture and cultivation of *Chlorella*

Unit-3: Introduction to Fungi — 8Hrs.

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

Unit-4: Biology of selected Fungi — 10Hrs.

1. Occurrence, structure, reproduction and life cycle of:
(a) Zygomycotina: *Rhizopus* (b) Ascomycotina: *Penicillium* (c) Basidiomycotina: *Puccinia*

Unit-5: Lichens — 7 Hrs.

1. Lichens: definition, phycobionts and mycobionts in lichens; morphology and internal structure of lichens; classification based on growth form, habitat and fungal partner.
2. Reproduction – vegetative, asexual and sexual methods.
3. Ecological and economic importance of lichens.

IV. 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

V. 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.

VI. 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 of economically valuable fungal products.

Evaluation method: Evaluating the collections made and awarding grade.

Unit-4: Activity: Group discussion/quiz/JAM on characteristics of various groups of algae.

Evaluation method: Assessment of the performance of individual/group of students based on a rubric.

Unit-5: 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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany- I Semester (W.E.F. 2025-26)
Major

COURSE 2: DIVERSITY OF THALLOPHYTES

Practical | 02 hours /Week | Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Identify some algal and fungal species based on the structure of thalli and reproductive organs.
2. Decipher the lichens based on morphological, anatomical and reproductive features.
3. Realize the value of algal, fugal and lichen products available in markets.

II. 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:** *Rhizopus, Penicillium* and *Puccinia*
5. Identification of some fungal products available in the local market.
6. **Lichens:** Crustose, foliose and fruiticose
7. Identification of some lichen products available in the local market.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Year B.Sc. HONOURS BOTANY
Practical Examinations at I Semester End (2025-26)
Model Paper
Major

COURSE 2: DIVERSITY OF THALLOPHYTES

Time: 2 Hrs. **Max. Marks: 50**

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1. Identify the given Algal material **A.** Make a temporary slide and justify the characters **10m**

2. Identify the given Fungal material **B.** Make a temporary slide and justify the characters **10m**

3. Identify the given Lichen material **C.** Make a temporary slide and justify the characters **10m**

4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**

   D- Algaal product

   E-Fungal product

   F-lichen product

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany / I Semester (W.E.F. 2025-26)
Major

COURSE 2: DIVERSITY OF THALLOPHYTES
QUESTION BANK

Unit-1: Introduction to Algae

Essay Questions

1. Describe the general characteristics of Algae.
2. Explain the economic importance of Algae.
3. Describe the Thallus organisation in algae.
4. Write about Fritsch classification of Algae.
5. Write about Cell structure of algae.
6. Write different types of life cycles in Algae.

Short Answer Questions

1. Pigments in algae.
2. Flagella in algae.
3. Reserve food materials in algae.
4. Occurrence and distribution of Algae.

Unit-2: Biology of Selected Algae

Essay Questions

1. Explain Occurance, Structure and Reproduction of Spirogyra.
2. Explain Occurance, Structure and Reproduction of Ectocarpus.
3. Explain Occurance, Structure and Reproduction of Polysiphonia.

Short Answer Questions

1. Germination of Zygospore in Spirogyra.
2. Differentiate between Scalariform and lateral conjugation.
3. Tetra sporophyte.
4. Culture of chlorella.
5. Cultivation Process of Chlorella.
6. Carposporophyte.

Unit-3: Introduction to Fungi

Essay Questions

1. Write about Thallus organisation in Fungi.
2. Describe the Nutrition in Fungi.
3. Explain Reproduction in Fungi.
4. Write about classification of Fungi (Ainsworth).
5. Explain the economic importance of Fungi.

Short Answer Questions

1. Heterothallism.
2. Parasexuality.
3. Ecological Importance of Fungi.

Unit-4: Biology of Selected Fungi

Essay Questions

1. Describe the Occurance, Structure and Reproduction of Rhizopus.
2. Give an account on Occurance, Structure and Reproduction of Penicillium.
3. Explain Occurance, Structure and Reproduction of Puccinia.

Short Answer Questions

1. Economic importance of Penicillium.
2. Control Measures of wheat rust.
3. Uredospores.
4. Teleutospores.
5. Pycniospores.
6. Aeciospore.

Unit-5: Lichens

Essay Questions

1. Explain the economic importance of Lichens.
2. Describe the vegetative reproduction methods in lichens.
3. Explain Sexual Reproduction in lichens.
4. Describe the types of lichens based on the internal structure.

Short Answer Questions

1. General characteristics of Lichens.
2. Phycobionts and mycobionts.
3. Classification of lichens based on habitat.
4. Classification of lichens based on fungal partner.
5. Ecological importance of Lichens.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
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COURSE 2: DIVERSITY OF THALLOPHYTES

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

1. Write different types of life cycles in Algae.
2. Explain Occurance, Structure and Reproduction of Ectocarpus.
3. Write about classification of Fungi (Ainsworth).

SECTION -B

4. Describe the Occurance, Structure and Reproduction of Rhizopus.
5. Explain the economic importance of Lichens.
6. Describe the Thallus organisation in algae.

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

7. Reserve food materials in algae.
8. Differentiate between Scalariform and lateral conjugation.
9. Parasexuality.
10. Economic importance of Penicillium.
11. Phycobionts and mycobionts.
12. Carposporophyte.
13. Teleutospores.

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I B.Sc Hons -Botany / I Semester (W.E.F. 2025-26)
Major

COURSE 2: DIVERSITY OF THALLOPHYTES

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
Unit-1: Introduction to Algae	2	1	25
Unit-2: Biology of Selected Algae	1	2	20
Unit-3: Introduction to Fungi	1	1	15
Unit-4: Biology of Selected Fungi	1	2	20
Unit-5: Lichens	1	1	15

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany- II Semester (W.E.F. 2025-26)
Major

COURSE 3: DIVERSITY OF ARCHEGONIATES

Credits -3

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

1. Explain the general characters, classification and significance of Bryophytes.
2. Discuss the morphological, anatomical and reproductive characters of Pteridophytes.
3. Acquire knowledge of evolutionary trends in Pteridophytes and their value.
4. Brief the morphological, anatomical and reproductive characters of Gymnosperms.
5. Summarize the evolutionary trends in Gymnosperms.

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

1. Compare and contrast the morphological, anatomical and reproductive features of some Bryophytes.
2. Illustrate the morphological, anatomical and reproductive characteristics of some Pteridophytes.
3. Infer the evolution of vasculature, heterospory, and seed habit in Pteridophytes.
4. Compare and contrast the morphological, anatomical and reproductive features of some Gymnosperms.
5. evaluate the evolutionary trends in Gymnosperms.

III. Syllabus of Theory:

Unit-1: Biology of Bryophytes — 9 Hrs.

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 the evolution of sporophytes in Bryophyta.

Unit-2: Biology of Pteridophytes — 10 Hrs.

1. General characteristics of Pteridophyta; Smith (1955) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Lycopsida: *Lycopodium* (b) Sphenopsida: Equisetum and (c) Filicopsida: *Marsilea*

Unit-3: Evolutionary trends in Pteridophytes — 8 Hrs.

1. Geological time scale; a brief account of *Rhynia*
2. Stelar evolution in Pteridophytes; heterospory and seed habit.
3. Ecological and economic importance of Pteridophytes.

Unit-4: Biology of Gymnosperms — 10 Hrs.

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* (b) Ginkgoopsida: *Ginkgo* and (b) Gnetopsida: *Gnetum*

Unit-5: Evolutionary trends in Gymnosperms 8 Hrs.

1. A brief account on fossilization processes and types of fossils.
2. A over view of *Cycadeoidea* and *Pentoxylon*
3. A summary of evolutionary trends in Gymnosperms.
4. Ecological and economic importance of Gymnosperms.

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. Shaw, A.J.& B.Goffinet (2000) Bryophyte Biology. Cambridge University Press, New York.
2. Smith, G.M. (1971) Cryptogamic BotanyVol. II., Tata McGraw Hill, New Delhi
3. Sharma,O.P.(2012) Pteridophyta. Tata McGraw-Hill, New Delhi
4. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
5. Coulter, J.M. & C.J.Chamberlain(1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
6. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Collection and identification of Bryophytes from their locality.

Evaluation method: Assessing the collections made by the student and assigning a grade.

Unit-2: Activity: Making temporary slides/models/drawings of Pteridophytes in the syllabus.

Evaluation method: Assessment of the temporary slides/model/drawing.

Unit-3: Activity: Group discussion/Quiz/JAM on evolutionary trends in Pteridophytes.

Evaluation method: Assessing the abilities of a group/ an individual based on the performance.

Unit-4: Activity: Study of wood elements in locally available Gymnosperms and making temporary slides.

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

Unit-5: Activity: Assignment/seminar on evolutionary trends in Gymnosperms-making comparative account.

Evaluation method: Evaluating the quality of assignment written with apt examples/quality of presentation using a rubric.

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Major

COURSE 3: DIVERSITY OF ARCHEGONIATES

Practical 02 hours /Week Credits -1

I. Course Outcomes: On successful completion of this practical course, the student shall be able to:

1. distinguish the Pteridophytes and Gymnosperms based on their morphological, anatomical and reproductive structures.
2. make systematic classification of plant species using vegetative and floral characters.
3. identify angiosperm plant species and make herbarium specimens.

II Laboratory/field exercises:

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

A. Bryophyta: *Marchantia, Anthoceros* and *Funaria*

B. Pteridophyta: *Rhynia, Lycopodium, Equisetum*, and *Marselia*

C. Gymnosperms: *Cycadeoidea, Pentoxylon*, *Cycas*, *Ginkgo* and *Gnetum*

2. Field trip to a Botanic garden or local floristic area/forest.

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Model Paper
Major

COURSE 3: DIVERSITY OF ARCHEGONIATES

Time: 2 Hrs. **Max. Marks: 50**

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1. Identify the given Bryophyte **A.** Make a temporary slide and justify the characters **10m**

2. Identify the given Pteridophyte **B.** Make a temporary slide and justify the characters **10m**

3. Identify the given Gymnosperm **C.** Make a temporary slide and justify the characters **10m**

4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**

   D- Bryphyta

   E-Pteridophyta

   F-Gymnosperm

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
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Major
COURSE 3: DIVERSITY OF ARCHEGONIATES
QUESTION BANK

Unit-1: Biology of Bryophytes

Essay Questions

1.Write down the general characters of Bryophyta.

2.Explain Reproduction and life cycle of Marchantia

3.Describe the Occurance, Morphology and anatomy of Funaria.

4.Describe the life cycle of Anthocerous.

5. Describe the Occurance, Morphology and anatomy of Marchantia.

Short Answer Questions

1.Rothmaler Classification

2.Morphology of Anthocerous

3.General characters of Bryopsida.

4.Evolution of sporophyte in Bryophyta.

Unit-2: Biology of Pteridophytes

Essay Questions

1. Describe the Occurance, Morphology and anatomy of Lycopodium.

2. Describe the structure of Rhizome in Marselia.

3. Explain Reproduction and life cycle of Equisetum.

4. Explain Reproduction and life cycle of Lycopodium.

Short Answer Questions

1.Describe the General Characters of Pteridophyta

2.Classification of Pteridophyta

3.General Characters of Lycopsida

4. External Morphology of Equisetum.

5.External morphology of Marselia.

6.Equisetum stem T.S

Unit-3: Evolutionary trends in Pteridophytes

Essay Questions

1.Describe the Stelar Evolution in Pteridophytes.

2.Detained note on Rhynia.

3. Ecological and Economic importance of Pteridophytes.

Short Answer Questions

1.Geological time scale.

2,Heterospory.

3.Seed Habitat.

Unit-4: Biology of Gymnosperms

Essay Questions

1. Describe the Occurance, Morphology and anatomy of *Cycas.*

2. Describe the Occurance, Morphology and anatomy of Ginkgo.

3. Explain the Reproduction and life history of Ginkgo.

4. Describe the Occurance, Morphology and anatomy of Gnetum.

5. Explain the Reproduction and life history of Gnetum.

Short Answer Questions

1.General Characters of Gymnospertms.

2. Classification of Gymnosperms.

3. Cycas Ovule.

4.Colloid roots of Cycas.

Unit-5: Evolutionary trends in Gymnosperms

Essay Questions

1.Explain the process of Fossilization.

2.Detailed note on Cyadeoidea.

3. Detailed note on Pentoxylon.

Short Answer Questions

1.Types of Fossils.

2.Ecological importance of Gymnosperms.

3.Economic importance of Gymnosperms.

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I B.Sc Hons -Botany / II Semester (W.E.F. 2025-26)
Major
COURSE 3: DIVERSITY OF ARCHEGONIATES

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

1. Describe the Occurance, Morphology and anatomy of Marchantia.
2. Explain Reproduction and life cycle of Equisetum.
3. Describe the Stelar Evolution in Pteridophytes.

SECTION -B

4. Explain the Reproduction and life history of Gnetum.
5. Explain the process of Fossilization.
6. Write down the general characters of Bryophyta.

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

7. Evolution of sporophyte in Bryophyta.
8. Classification of Pteridophyta
9. Heterospory.
10. General Characters of Gymnospertms.
11. Economic importance of Gymnosperms.
12. External morphology of Marselia.
13. Cycas Ovule.

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I B.Sc Hons -Botany / II Semester (W.E.F. 2025-26)
Major
COURSE 3: DIVERSITY OF ARCHEGONIATES

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
Unit-1: Biology of Bryophytes	2	1	25
Unit-2: Biology of Pteridophytes	1	2	20
Unit-3: Evolutionary trends in Pteridophytes	1	1	15
Unit-4: Biology of Gymnosperms	1	2	20
Unit-5: Evolutionary trends in Gymnosperms	1	1	15

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany- II Semester (W.E.F. 2025-26)
Major

COURSE 4: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Credits -3

I. Learning Objectives: By the end of this course the learner has to:
1. Deliberate about various types of tissues in plants and their organization.
2. Explain anomalous secondary growth in plants and economic value of woods.
3. Debate on structure of anther and development of male gametophyte in plants.
4. Discuss the structure of ovules and process of fertilization.
5. Explain the embryo development and seed structure in monocots and dicots.

II. Course Outcomes: On completion of this course students will be able to:
1. Categorize various tissues and evaluate their role in plants.
2. Explain anomalous secondary growth in some plants and justify the value of timber plants.
3. Summarize the events in micro-sporogenesis and development of male gametophyte.
4. Illustrate the events in mega-sporogenesis and development of female gametophyte.
5. Propose the incidents in embryogenesis and structure of seeds in angiosperms.

III. Syllabus of Theory:

Unit – 1: Tissues in plants **8 Hrs.**

1. Meristematic tissues: Definition, classification, structure and functions.
2. Apical meristems: Generalized 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); a brief account of plant secretory tissues/cells.

Unit-2: Anomalous growth in plants 10Hrs.

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

Unit-3: Anther and pollen 10Hrs.

1. Anther: Structure and functions of anther wall, micro-sporogenesis.
2. Pollen wall structure, NPC system; development of male gametophyte, MGU (male germ unit).
3. Pollen wall proteins; pollen viability, storage and germination; abnormal features: Pseudomonads and polyads; Nemec phenomenon.
4. A brief account of palynology and its scope.

Unit-4: Ovules, fertilization and endosperm 10Hrs.

1. Structure and types of ovules, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
2. Pollination: types of self and cross pollination – contrivances; agents of 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 7Hrs.

1. Embryo development in dicot (*Capsella bursa-pastoris*) and monocot (*Sagittaria sagittifolia*) plants.
2. Seed structure in monocot and dicot; importance of seed and seed dispersal mechanisms.
3. Polyembryony and apomixes: Introduction, classification, causes and applications.

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, Volume-II, New Central 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.
3. 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.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. 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

VI. 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.

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Major

Practical | Credits: 1 | 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Conduct dissections of various plant organs and study the internal structures by staining.
2. Explain the embryological characteristics from sex organs to seeds in angiosperms.
3. Demonstrate skills in studying anatomical and embryological features of angiosperms.

II. 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 ovules 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.

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Model Paper
Major

COURSE 4: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Time: 2 Hrs. **Max. Marks: 50**

1. **(A)** Anamalous Secondary growth in Boerhavaia **12m**
2. **(B)** Dissection and observation of Endosperm haustoria in *Crotalaria* **10m**
3. **(C).** Study of pollen germination and pollen viability **8m**

3. Identify the given Spotters and justify the characters. **12m**

C- Tissue organization in shoot apices

D- dicot / monocot embryos

E- Types of ovules

5.Record + Viva voce **5+3 = 8m**

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Major
COURSE 4: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS
QUESTION BANK

Unit-1: Tissues in plants

Essay Questions

1. Write an essay on permanent tissues
2. Described the structure and functions of meristematic tissues.
3. Illustrate the Tunica-Corpus theory on organization of Shoot Apical Meristem.

Short Questions

1. Describe the classification of meristematic tissues
2. Short note on Histogen theory.
3. Brief account on plant secretory tissues.

Unit-2: Anomalous growth in plants

Essay Questions

1. Write an essay on vascular tissue systems.
2. Describe the anomalous secondary growth in *Boerhaavia* stem
3. Describe the anomalous secondary growth in *Dracaena* stem.
4. Give an account on economic importance of Teak and Red-sanders

Short Questions

1. Write the applications of anatomy in plant systematics.
2. Describe the epidermal tissue systems.
3. Brief account on economic importance of Rosewood

Unit-3: Anther and pollen

Essay Questions

1. Write an essay on pollen viability, storage and germination.
2. Describe the structure and functions of anther wall.
3. Illustrate the process of microsporogenesis.

Short Questions

1. What is the scope of palynology.
2. Explain the MGU structure.

3. Brief note on pollen wall proteins.
4. Describe the Pollinia

Unit-4: Ovules, fertilization and endosperm

Essay Questions

1. Write an essay on monosporic type of embryo sac.
2. Describe the process of double fertilization in angiosperms.
3. Describe the Types of Endosperm

Short Questions

1. Write a short note on types of ovules
2. Explain megasporogenesis.
3. Brief note on perisperm.
4. Agents of Pollination.

Unit-5: Embryology and Seeds

Essay Questions

1. Write an essay on embryogeny in dicot.
2. Explain the importance of seed and seed dispersal mechanism.
3. Detailed note on polyembryony

Short Questions

1. Write Short note on apomixes.
2. Describe the seed structure in dicot.
3. Brief note on embryogeny in monocot.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany / II Semester (W.E.F. 2025-26)
Major
COURSE 4: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

1. Described the structure and functions of meristematic tissues.
2. Describe the anomalous secondary growth in *Boerhaavia* stem.
3. Describe the structure and functions of anther wall.

SECTION -B

4. Describe the process of double fertilization in angiosperms.
5. Detailed note on polyembryony.
6. Give an account on economic importance of Teak and Red-sanders.

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

7. Brief account on plant secretory tissues.
8. Write the applications of anatomy in plant systematics.
9. What is the scope of palynology.
10. Explain megasporogenesis.
11. Write Short note on apomixes.
12. Brief note on pollen wall proteins.
13. Brief note on embryogeny in monocot.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc Hons -Botany / II Semester (W.E.F. 2025-26)
Major
COURSE 4: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
Unit-1: Tissues in plants	1	1	15
Unit-2: Anomalous growth in plants	2	1	25
Unit-3: Anther and Pollen	1	2	20
Unit-4: Ovules, fertilization and endosperm	1	1	15
Unit-5: Embryogeny and Seeds	1	2	20

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc Hons -Botany-III / III Semester (W.E.F. 2025-26)
Major & Minor

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:

1. Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.
2. Illustrate the general characteristics of Gymnosperms along with their uses
3. Discuss about some Taxonomic aids and their applications in plant systematics.
4. Compare and contrast the vegetative and floral characteristics of some angiospermic families
5. Evaluate the economic value of plant species from the families under the study.
6. Defend the utility of evidences from different branches of botany in solving the taxonomic lineages of some species.

III. Syllabus of Theory:

Unit-1: Pteridophytes **10Hrs.**

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 **10Hrs.**

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 **10 Hrs.**

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 **8 Hrs.**

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 **7Hrs.**

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.

IV. Text Books:

1. Acharya, B.C., (2019) Archegoniates, 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, NewDelhi
6. Samba murty, 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.
8. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA,U.S.A.

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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)
Major & Minor

Course 5 : Vascular Plants

(Pteridophytes, Gymnosperms and Angiosperm Taxonomy)

Practical | 02 hours /Week | Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Distinguish the Pteridophytes and Gymnosperms based on their morphological, anatomical and reproductive structures.
2. Make systematic classification of plant species using vegetative and floral characters.
3. Identify angiosperm plant species and make herbarium specimens.

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).

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Practical Examinations at III Semester End (2025-26)
Model Paper
Major & Minor

Course 5 : Vascular Plants

(Pteridophytes, Gymnosperms and Angiosperm Taxonomy)

Time: 2 Hrs. **Max. Marks: 50**

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1. Identify the given Pteridophyte material **A.** Make a temporary slide and justify the characters

10m

2. Identify the given Gymnosperm material **B.** Make a temporary slide and justify the characters

10m

3. Identify the given twig material **C.** Write down the Taxonomic description of given material

10m

4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**

D- Pteridophytes

E-Gymnosperms

F-Taxonomy

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc Hons -Botany-III / III Semester (W.E.F. 2025-26)
Major & Minor

Course 5 : Vascular Plants

(Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

QUESTION BANK

Unit-1: Pteridophytes

Essay Questions

S.No	Question
1	Write an essay on Marselia Rhizome
2	Give a detailed note on Stelar evolution in Pteridophytes
3	Give a detailed note on Lycopodium rhizome

Short Questions

S.No	Question
1	Write a short note on Heterospory
2	Describe L.S of Lycopodium cone
3	Explain Protostele

Unit-2: Gymnosperms

Essay Questions

S.No	Question
1	Define Sexual reproduction in Gnetum
2	Describe the general characters of Gymnosperms
3	Detailed note on anatomy of cycas leaflet

Short Questions

S.No	Question
1	Describe the structure of cycas ovule
2	Explain about colloid root of cycas
3	Explain Pteridophytic characters in Gymnosperms

Unit-3: Principles of Plant Taxonomy

Essay Questions

S.No	Question
1	Write about ICBN
2	Brief account on Bentham and Hooker classification
3	Explain various steps involved in Herbarium preparation

Short Questions

S.No	Question
1	What is Binomial Nomenclature
2	Describe Typification
3	Brief note on APG-IV

Unit-4: Descriptive Plant Taxonomy

Essay Questions

S.No	Question
1	Write Systematic position and taxonomical description of the family Cucurbitaceae
2	Write Systematic position and taxonomical description of the family Asclepiadaceae
3	Write Systematic position and taxonomical description of the family Euphorbiaceae
4	Write Systematic position and taxonomical description of the family Poaceae

Short Questions

S.No	Question
1	Write about tendrils in cucurbitaceae
2	Describe Cyathium
3	Explain Head inflorescence

Unit-5: Evidences for Plant systematics

Essay Questions

S.No	Question
1	Explain anatomy and embryology in relation to taxonomy
2	Explain cytology and cytogenetics in relation to taxonomy
3	Detailed note on Phytochemistry in relation to plant systematics

Short Questions

S.No	Question
1	Write a short Double fertilization and triple fusion
2	Brief note role of fruit in the evolution of angiosperms
3	How did the evolution of flowers contribute to the success of angiosperms

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc Hons -Botany-III / III Semester (W.E.F. 2025-26)
Major & Minor

Course 5 : Vascular Plants

(Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

S.No	Question
1	Give a detailed note on Stelar evolution in Pteridophytes
2	Describe the general characters of Gymnosperms
3	Brief account on Bentham and Hooker classification

SECTION -B

S.No	Question
4	Write Systematic position and taxonomical description of the family Asclepiadaceae
5	Explain anatomy and embryology in relation to taxonomy
6	Write Systematic position and taxonomical description of the family Euphorbiaceae

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

S.No	Question
7	Write a short note on Heterospory
8	Describe the structure of cycas ovule
9	What is Binomial Nomenclature
10	Write about tendrils in cucurbitaceae
11	Write a short Double fertilization and triple fusion
12	Explain Pteridophytic characters in Gymnosperms
13	How did the evolution of flowers contribute to the success of angiosperms

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc Hons -Botany-III / III Semester (W.E.F. 2025-26)
Major & Minor

Course 5 : Vascular Plants

(Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

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UNIT	Essays	Shorts	Marks Alloted
Unit-1: Pteridophytes	1	1	25
Unit-2: Gymnosperms	1	2	20
Unit-3: Principles of Plant Taxonomy	1	1	15
Unit-4: Descriptive Plant Taxonomy	2	1	15
Unit-5: Evidences for Plant systematics	1	2	20

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

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:

1. Identify major groups of plant pathogens and classify plant diseases.
2. Explain various stages in infection, plant pathogenesis and responsible factors.
3. Elaborate the preventive and control measures for plant diseases.
4. Discuss about some diseases of field crops and their management.
5. Discuss about some diseases of horticultural crops and their management.

III. Syllabus of Theory:

Unit-1: Plant pathogens, survival and dispersal **8 Hrs.**

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 **8 Hrs.**

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 **8 Hrs.**

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 **12 Hrs.**

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 **9 Hrs.**

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

d) Coconut: Bud rot and Basal stem rot

IV. 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

V. 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.

VI. 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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

Course 6: Plant Pathology and Plant Diseases

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Handle equipment and instruments in plant pathology laboratory.
2. Isolate plant pathogenic microbes.
2. Identify the plant diseases based of histopathological observations.

II. 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.

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II Year B.Sc. HONOURS BOTANY
Practical Examinations at III Semester
Model Paper

Course 6: Plant Pathology and Plant Diseases
(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

1. Isolation and Identification of plant pathogenic fungi **(A)**. **10m**
2. Isolation and Identification of plant pathogenic bacteria**(B).** **10m**
3. Identification of phanerogamic plant parasites **(C).** **10m**
4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**

D- plant pathological laboratory and field equipment.

E- plant pathogenic nematodes.

F- selected diseases of field crops/ Horticulture crops

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

Course 6: Plant Pathology and Plant Diseases

QUESTION BANK

Unit-1: Plant pathogens, survival and dispersal

Essay Questions

S.No	Question
1	Write an essay on Plant pathology its importance, scope and objectives of plant pathology
2	Give a detailed note on important plant pathogenic organisms with examples of diseases caused by them
3	Classify plant diseases based on important criteria

Short Questions

S.No	Question
1	Write a short note on Important faminies in world
2	Describe the role of alternate hosts in the survival of plant pathogens
3	Explain how cultural practices impact the survival of plant pathogens

Unit-2: Infection and pathogenesis in plants

Essay Questions

S.No	Question
1	Define the process of infection
2	Describe the role of Enzymes in plant pathogenesis
3	Detailed note on role of defense mechanism in plant s against pathogens

Short Questions

S.No	Question
1	What is the significance of mycotoxins in plant pathogens
2	How do toxins contribute to the symptom development in plants
3	How do plants counteract the enzymatic attack by pathogens

Unit-3: Plant disease management

Essay Questions

S.No	Question
1	Write about general principles of plant disease management
2	Brief account on cultural methods biological control of PGPR
3	Detailed note on Integrated plant diseases management - IDM

Short Questions

S.No	Question
1	What is the role of siderophores produced by PGPR
2	What role do international standards play in regulatory methods
3	Brief note on Plant disease forecasting

Unit-4: Diseases of field crops

Essay Questions

S.No	Question
1	Write brief note on etiology, disease cycle and management of Blast disease of Rice
2	Detailed note on etiology, disease cycle and management of Ergot of Bajra
3	Detailed note on etiology, disease cycle and management of Red rot of Sugarcane

Short Questions

S.No	Question
1	Write about Tikka disease in groundnut
2	Describe Tungro disease
3	Explain Phtopthora blight

Unit-5: Diseases of horticultural crops

Essay Questions

S.No	Question
1	Write brief note on etiology, disease cycle and management of Phomopsis blight of brinjal
2	Detailed note on etiology, disease cycle and management of Powdery mildew of okra
3	Detailed note on etiology, disease cycle and management of Bud rot of Coconut

Short Questions

S.No	Question
1	Write a short Bunchy top of Banana
2	Brief note on anthracnose of pomegranate
3	Brief note on Yellow vein mosaic of okra

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Course 6: Plant Pathology and Plant Diseases

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

S.No	Question
1	Write an essay on Plant pathology its importance, scope and objectives of plant pathology
2	Describe the role of Enzymes in plant pathogenesis
3	Brief account on cultural methods biological control of PGPR

SECTION -B

S.No	Question
4	Write brief note on etiology, disease cycle and management of Blast disease of Rice
5	Write brief note on etiology, disease cycle and management of Phomopsis blight of brinjal
6	Detailed note on etiology, disease cycle and management of Red rot of Sugarcane

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

S.No	Question
7	Write a short note on Important faminies in world
8	How do toxins contribute to the symptom development in plants
9	Brief note on Plant disease forecasting
10	Write about Tikka disease in groundnut
11	Write a short Bunchy top of Banana
12	What is the significance of mycotoxins in plant pathogens
13	Brief note on anthracnose of pomegranate

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Course 6: Plant Pathology and Plant Diseases

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UNIT	Essays	Shorts	Marks Alloted
Unit-1: Plant pathogens, survival and dispersal	1	1	25
Unit-2: Infection and pathogenesis in plants	1	2	20
Unit-3: Plant disease management	1	1	15
Unit-4: Diseases of field crops	2	1	15
Unit-5: Diseases of horticultural crops	1	2	20

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

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:

1. Compare and contrast the methods of reproduction and also pollination mechanisms.
2. Recommend the best possible breeding method for a crop species.
3. Propose the steps for production of hybrid varieties of crop plants.
4. Apply molecular techniques to develop a tailored plant variety.
5. Discuss about modern methods in Plant Breeding

III. Syllabus of Theory:

Unit-1: Basic concepts of plant breeding **8 Hrs.**

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 **7 Hrs.**

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 **9 Hrs.**

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.

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

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.

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

IV. 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

V. 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.

VI. 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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

Course 7: Plant Breeding

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Distinguish self and cross-pollinated plant species based on floral biology.
2. Perform skills related to self and cross pollination in plants.
3. Make hybridization to produce new varieties.

II. 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.

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Model Paper

Course 7: Plant Breeding

(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

1. Pollen viability test. **(A)**. **15m**

2. Observation on pollen Germination. **(B).** **07m**

3. Identify the given Spotters and justify the characters. **4 X 5 = 20m**

C- Self and a cross pollinated plant species

D- Selfing and crossing techniques.

E- Emasculation technique

F- Pollination mechanism

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

Course :- 7 Plant Breeding

QUESTION BANK

Unit-1: Basic concepts of plant breeding

Essay Questions

S.No	Question
1	Write an essay on aim, objectives and scope of plant breeding
2	Give a detailed account on advantages and disadvantages of sexual and asexual reproduction
3	Classify crop plants based on mode of pollination and reproduction

Short Questions

S.No	Question
1	Write a short note Apomixis
2	Describe Selection in plant breeding
3	Explain Genetic variation

Unit-2: Contrivances for cross pollination

Essay Questions

S.No	Question
1	Write an essay on Self incompatibility and exploitation of it in hybrid production
2	Define male sterility and types, utilization of it in plant breeding
3	Detailed note on centres of origin of crop plants

Short Questions

S.No	Question
1	Write about exploitation of self incompatibility
2	Describe cytoplasmic male sterility
3	Describe Domestication of Plants

Unit-3: Breeding methods in plants

Essay Questions

S.No	Question
1	Write about pure line selection.
2	Define Selection, write about basic principles of selection
3	Explain plant introduction, types and objectives, its merits and demerits

Short Questions

S.No	Question
1	Write a short on Gene erosion
2	Describe Gene sanctuaries
3	Brief note on Clonal selection

Unit-4: Breeding methods in cross-pollinated plants

Essay Questions

S.No	Question
1	Write about Hybridization – objectives, types, procedures, advantages, disadvantages, achievements
2	Write about back cross method

Short Questions

S.No	Question
1	Write about Heterosis
2	Describe cross pollination
3	Describe commercial utilization of heterosis
4	Explain Synthetics and composites

Unit-5: Modern methods in plant breeding

Essay Questions

S.No	Question
1	Write an essay on Mutation Breeding
2	Detailed note on Polyploidy breeding, applications in crop improvement
3	Detailed note on DNA markers and their appli ations in Plant breeding

Short Questions

S.No	Question
1	Write a short note Spontaneous and induced mutations
2	Brief note on autopolyploid and allopolyploid
3	Brief note on Marker assisted selections

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II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

Course :- 7 Plant Breeding

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

S.No	Question
1	Write an essay on aim, objectives and scope of plant breeding
2	Define male sterility and types, utilization of it in plant breedding
3	Define Selection, write about basic principles of selection

SECTION -B

S.No	Question
4	Write about Hybridization – objectives, types, procedures, advantages, disadvantages, achievements
5	Detailed note on Polyploidy breeding, applications in crop improvement
6	Write about back cross method

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

S.No	Question
7	Write a short note Apomixis
8	Describe cytoplasmic male sterility
9	Describe Gene sanctuaries
10	Describe commercial utilization of heterosis
11	Write a short note Spontaneous and induced mutations
12	Describe Domestication of Plants
13	Brief note on autopolyploid and allopolyploid

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc., -Botany-III / III Semester (W.E.F. 2025-26)

Course :- 7 Plant Breeding

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
Unit-1: Basic concepts of plant breeding	1	1	25
Unit-2: Contrivances for cross pollination	1	2	20
Unit-3: Breeding methods in plants	1	1	15
Unit-4: Breeding methods in cross-pollinated plants	2	1	15
Unit-5: Modern methods in plant breeding	1	2	20

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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:

1. Explain the scientific techniques and tools used in plant tissue culture laboratories.
2. Appraise the applications of plant tissue culture in agriculture and horticulture sectors.
3. Acquire skills related to various aspects in plant tissue culture.
4. Evaluate the role of transgenic plants in solving certain plant related beneficiary issues.
5. Justify the role of plant biotechnology in bioenergy and phytoremediation.
6. Judge the biosafety and bioethics related to plant biotechnology.

III. Syllabus of Theory:

UNIT-1: Basic techniques in plant tissue culture **10 Hrs.**

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 **8 Hrs.**

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 **12 Hrs.**

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. **8 Hrs.**

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).

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.

IV. Text Books:

1. Ignacimuthu , S., (2003) Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Kalyan Kumar De., (1997) Plant Tissue Culture – New Central Book Agency (P) Ltd., Calcutta.
3. Mascarenhas A.F., (1991) Hand book of Plant Tissue Culture. Indian Council of Agricultural Research. New Delhi.

4. 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.
2. Adrian Slater, Nigel W. Scott, and Mark R. Fowler (2008) Plant Biotechnology: The Genetic Manipulation of Plants Oxford University Press in Oxford, UK.
3. S. Mohan Jain and Pramod K. Gupta (2010) Plant Biotechnology: Methods and Applications CRC Press, Taylor & Francis Group in Boca Raton, Florida, USA.
4. Ram Lakhan Singh (2017) Plant Biotechnology: Recent Advances and Future Prospects Springer International Publishing AG in Cham, Switzerland.
5. Altman and P.M. Hasegawa (2013) Plant Biotechnology and Agriculture: Prospects for the 21st Century Elsevier Inc. in Amsterdam, Netherlands.

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 **s**kills 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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Course 8: Plant Biotechnology

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Operate all the equipment and instruments in a plant tissue culture laboratory.
2. Establish callus and organ culture.
3. Obtain quality plants using micro-propagation techniques.

II. 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.

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Course 8: Plant Biotechnology

(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

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1. **(A)** Preparation of culture media. **15m**

2. **(B)**Demonstration of anther and pollen culture**.** **12m**

3. Identify the given Spotters and justify the characters. **3 X 5 = 15m**

C- Equipments used in tissue culture laboratory

D- Organ culture

E- Transgenic plants

5.Record + Viva voce **5+3 = 8m**

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II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2025-26)

Course 8: Plant Biotechnology

QUESTION BANK

UNIT-1: Basic techniques in plant tissue culture

Essay Questions

S.No	Question
1	Write an essay on Scope and significance of plant tissue culture
2	Describe various physical and chemical methods of sterilization
3	Give an account on composition of M.S media

Short Questions

S.No	Question
1	Write a short note Synthetic seeds
2	Describe callus culture
3	Explain the role of hormones in plant tissue culture
4	Brief note on somatic embryos

UNIT-2: Organ and haploid culture techniques

Essay Questions

S.No	Question
1	Write an essay on Meristem culture
2	Describe Micropropagation technique, mention its merits and demerits
3	Detailed note Anther and pollen culture

Short Questions

S.No	Question
1	Write about ovule culture
2	Describe Ovary culture
3	Describe Endosperm culture
4	Brief note on Embryo culture

UNIT-3: Cell and protoplast cultures

Essay Questions

S.No	Question
1	Write an essay on Somatic hybridization
2	Give an account on Protoplast culture

Short Questions

S.No	Question
1	Write a short on Biotransformation
2	Describe the methods used for protoplast isolation
3	Brief note on Cybrids

UNIT-4: Transgenic plants.

Essay Questions

S.No	Question
1	What are transgenic plants? Describe the herbicide resistance, insect resistance plants
2	Give an detailed note on virus resistance and disease resistance (antifungal and PR proteins) of transgenic plants

Short Questions

S.No	Question
1	Write about Golden rice
2	Describe mechanism of Bt cotton
3	Describe PR proteins
4	Explain Flavr savr tomato

UNIT-5: Advances in plant biotechnology

Essay Questions

S.No	Question
1	Write an essay on Biofortification and genetically modified food
2	Detailed note on applications of Plant Biotechnology to produce plant based vaccines and therapeutics
3	Detailed note on Bio energy production and environmental remediation

Short Questions

S.No	Question
1	Write a short note on Biodegradable plastic
2	Brief note on Bio energy production
3	Brief note on Bioreactors

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II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2025-26)

Course 8: Plant Biotechnology

MODEL PAPER

Time :- 2Hrs
Max Marks :- 50M

PART - A

I. Answer any three of the following questions choosing atleast one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

S.No	Question
1	Write an essay on Scope and significance of plant tissue culture
2	Describe Micropropagation technique, mention its merits and demerits
3	Give an account on Protoplast culture

SECTION -B

S.No	Question
4	What are transgenic plants? Describe the herbicide resistance, insect resistance plants
5	Detailed note on applications of Plant Biotechnology to produce plant based vaccines and therapeutics
6	Give an account on composition of M.S media

PART - B

II. Answer any Four of the following questions choosing atleast one from each section, draw diagrams wherever necessary **4 X 05 = 20 M**

S.No	Question
7	Write a short note Synthetic seeds
8	Describe Ovary culture
9	Describe the methods used for protoplast isolation
10	Describe PR proteins
11	Brief note on Bioreactors
12	Brief note on Embryo culture
13	Write a short note on Biodegradable plastic

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Course 8: Plant Biotechnology

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
UNIT-1: Basic techniques in plant tissue culture	2	1	25
UNIT-2: Organ and haploid culture techniques	1	2	20
UNIT-3: Cell and protoplast cultures	1	1	15
UNIT-4: Transgenic plants.	1	1	15
UNIT-5: Advances in plant biotechnology	1	2	20

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

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:

1. Categorize various tissues and evaluate their role in plants.
2. Explain anomalous secondary growth in some plants and justify the value of timber plants.
3. Summarize the events in micro-sporogenesis and development of male gametophyte.
4. Discuss the events in mega-sporogenesis and development of female gametophyte.
5. Propose the incidents in embryogenesis of an angiospermic plant species.
6. Compile the aspects of developmental and reproductive biology in plants.

III. Syllabus of Theory:

Unit – 1: Tissues in plants **8 Hrs.**

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 secretory tissues/cells.

Unit-2: Anomalous growth in plants **10Hrs.**

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 **10Hrs.**

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 **10Hrs.**

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 self-incompatibility (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 **7Hrs.**

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.

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, Volume-II, New Central 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.
3. 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.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. 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

VI. 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.

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Course 9: Anatomy and Embryology of Angiosperms

Credits -1

Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Conduct dissections of various plant organs and study the internal structures by staining.
2. Look into the embryological characteristics from sex organs to seeds in angiosperms.

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.

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Model Paper

Course 9: Anatomy and Embryology of Angiosperms
(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

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1. **(A)** Anamalous Secondary growth in Boerhavaia **12m**
2. **(B)** Dissection and observation of Endosperm haustoria in *Crotalaria* **10m**

3.(C). Study of pollen germination and pollen viability **8m**

3. Identify the given Spotters and justify the characters. **3 X 4= 12m**

C- Tissue organization in shoot apices

D- dicot / monocot embryos

E- Types of ovules

5.Record + Viva voce **5+3 = 8m**

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Course 9: Anatomy and Embryology of Angiosperms

QUESTION BANK

Unit-1: Tissues in plants

Essay Questions

S.No	Question
1	Write an essay on permanent tissues
2	Described the structure and functions of meristematic tissues
3	Illustrate the Tunica-Corpus theory on organization of Shoot Apical Meristem

Short Questions

S.No	Question
1	Describe the classification of meristematic tissues
2	Short note on Histogen theory
3	Brief account on plant secretory tissues

Unit-2: Anomalous growth in plants

EssayQuestions

S.No	Question
1	Write an essay on vascular tissue systems
2	Describe the anomalous secondary growth in *Boerhaavia* stem
3	Describe the anomalous secondary growth in *Dracaena* stem
4	Give an account on economic importance of Teak and Red-sanders

Short Questions

S.No	Question
1	Write the applications of anatomy in plant systematics
2	Describe the epidermal tissue systems
3	Brief account on economic importance of Rosewood

Unit-3: Anther and pollen

Essay Questions

S.No	Question
1	Write an essay on pollen viability, storage and germinatin
2	Describe the structure and functions of anther wall
3	Illustrate the process of microsporogenesis

Short Questions

S.No	Question
1	What is the scope of palynology
2	Explain the MGU structure
3	Brief note on pollen wall proteins
4	Describe the Pollinia

Unit-4: Ovules, fertilization and endosperm

Essay Questions

S.No	Question
1	Write an essay on monosporic type of embryo sac
2	Describe the process of double fertilization in angiosperms
3	What are the methods to overcome self-incompatibility

Short Questions

S.No	Question
1	Describe the different types of endosperms
2	Write a short note on types of ovules
3	Explain the megasporogenesis
4	Brief note on perisperm

Unit-5: Embryology and Seeds

Essay Questions

S.No	Question
1	Write an essay on embryogeny in dicot
2	Explain the importance of seed and seed dispersal mechanism
3	Detailed note on polyembryony

Short Questions

S.No	Question
1	Write Short note on apomixes
2	Describe the seed structure in dicot
3	Brief note on embryogeny in monocot

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Course 9: Anatomy and Embryology of Angiosperms

MODEL PAPER

PART - A

I. Answer any three of the following questions choosing at least one from each section, draw diagrams wherever necessary **3 X 10 = 30 M**

SECTION -A

S.No	Question
1	Described the structure and functions of meristematic tissues
2	Give an account on economic importance of Teak and Red-sanders
3	Describe the anomalous secondary growth in *Boerhaavia* stem

SECTION -B

S.No	Question
4	Illustrate the process of microsporogenesis
5	What are the methods to overcome self-incompatibility
6	Explain the importance of seed and seed dispersal mechanism

PART - B

II. Answer any Four of the following questions **4 X 05 = 20 M**

S.No	Question
7	Brief account on plant secretory tissues
8	Write the applications of anatomy in plant systematics
9	Brief note on pollen wall proteins
10	Explain the megasporogenesis
11	Brief note on embryogeny in monocot
12	Describe the different types of endosperms
13	Describe the Pollinia

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Course 9: Anatomy and Embryology of Angiosperms

BLUE PRINT

UNIT	Essays	Shorts	Marks Alloted
Unit-1: Tissues in plants	1	1	15
Unit-2: Anomalous growth in plants	2	1	25
Unit-3: Anther and Pollen	1	2	20
Unit-4: Ovules, fertilization and endosperm	1	1	15
Unit-5: Embryogeny and Seeds	1	2	20

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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:

1. Explain the interactions among the biotic and abiotic components in an ecosystem.
2. Summarize the characteristics of a population and a community.
3. Anticipate the environmental problems arising due to climate change.
4. Assess the value of biodiversity and choose appropriate conservation strategy.
5. Make a survey on the distribution of various plant groups in a specified geographical area.

III. Syllabus of Theory:

Unit-1: Basic concepts in ecology **10 Hrs.**

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 **10Hrs.**

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 **8Hrs.**

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 **10Hrs**

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 **7 Hrs.**

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.

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

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.

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Course 10: Plant Ecology, Biodiversity and Phytogeography

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Handle instruments used in ecological studies.
2. Perform experiments and collect data on autecology and synecology.
3. Identify various plant groups based on their morphological and anatomical adaptations.
4. Collect data on biodiversity and phytogeography.

II. 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.

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II Year B.Sc. HONOURS BOTANY
Practical Examinations at IV Semester
Model Paper

Course 10: Plant Ecology, Biodiversity and Phytogeography
(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

1. **(A)** Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance. **12m**

2. **(B)** Study of morphological and anatomical adaptations of given hydrophytes **10m**

3.(C). Mapping of phytogeographical regions of the globe and India **5m**

3. Identify the given Spotters and justify the characters. **3X 5= 15m**

D- Ecology instruments

E- Biodiversity hotspots in India (Map)

F- xerophytes

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 10: Plant Ecology, Biodiversity and Phytogeography

QUESTION BANK

UNIT- I - Basic concepts of Ecology

ESSAY QUESTIONS:-

S.NO	QUESTION
1.	Define Ecology? Explain about relation with other branches and significance of Ecology?
2	Explain about Structure and Functions of ecosystem?
3	Explain briefly about Nitrogen cycle ?
4	Explain about climatic factors (light and temperature)?

SHORTS

S.NO	QUESTION
1	Describe about Ecological pyramids ?
2	Explain about Food chain ?
3	Explain about Biotioc components ?

UNIT -ll - Population And Community

Ecology ESSAY QUESTIONS:-

S.NO	QUESTION
1	Define Population ecology ?Explain about characteristics of Population Ecology?
2	Explain about Ecological Sucession ?
3	Prepare a essay on characteristics of community Ecology ?

SHORTS

S.NO	QUESTION
1	Descrbe about GPP ?
2	Explain about life forms ?
3	Explain about Biological spectrum ?

UNIT- III- Climate Change -Impacts

ESSAY QUESTIONS: -

S.NO	QUESTION
1	Explain about causes and Consequences of Soil Degradation?
2	Describe about Causes and Effects of Global warming?
3	Explain about causes and Consequences of Deforestation and forest fires ?

SHORTS

S.NO	QUESTION
1	Describe about Ozone layer depletion?
2	Explain about Causes and Management strategies of Deforestation ?
3	Explain about The Montreal and Kyoto Protocol ?

UNIT - IV - Concepts of Biodiversity

ESSAY QUESTIONS:-

S.NO	QUESTION
1	Define Biodiversity? Explain about Levels of Biodiversity?
2	Describe about Biodiversity Hotspot in India ?
3	Explain about values of Biodiversity with examples ?
4	Prepare a short note on causes of acid rains ?

SHORTS

S.NO	QUESTION
1	Describe about Role of NBPGR in conservation Of Biodiversity?
2	Explain about Threats of Biodiversity ?
3	Explain about IUCN threat Categories ?
4	Prepare a short on Earth summit ?

UNIT -5 - PHYTOGEOGRAPHY

ESSAYS

S.NO	QUESTION
1	Define Phytogeograpy ? Explain about Phytogeographic regions in india ?
2	Explain about Endemism and Describe about types and causes of Endemism?
3	Explain about Distribution of Phytogeography?

SHORTS

S.NO	QUESTION
1	Describe about Principles of Phytogeography?
2	Define Phytogeograpy and Explain continuous and discontinuous distribution?
3	Explain about Vegetation types of Andhra pradesh ?

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 10: Plant Ecology, Biodiversity and Phytogeography

MODEL PAPER

Max marks – 50
Time – 2 hrs

PART - I

Answer any three questions from the following questions choosing atleast one from each section
3 X 10 = 30 M

PART-A

SECTION - I

1. Define Ecology? Explain about relation with other branches and significance of Ecology?
2. Explain briefly about Nitrogen cycle?
3. Explain about Concepts of productivity ?

PART-B

4. Describe about Causes and Effects of Global warming?
5. Define Biodiversity? Explain about Levels of Biodiversity?
6. Explain about Endemism and Describe about types and causes of Endemism?

PART – II

Answer any four of the following questions **4 X 5 = 20M**

7. Explain about Food chain ?
8. Explain about GPP ?
9. Describe abou Ozone layer depletion ?
10. Explain about Causes and Management strategies of Deforestation?
11. Prepare a short on Earth Summit ?
12. Describe about Role of NBPGR in conservation Of Biodiversity ?
13. Explain about Vegetation types of Andhra pradesh ?

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 10: Plant Ecology, Biodiversity and Phytogeography

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UNIT NO / TITLE	ESSAYS	SHORTS	MARKS ALLOTED
UNIT -I	2	1	25
UNIT -II	1	1	15
UNIT- III	1	2	20
UNIT- IV	1	2	20
UNIT- V	1	1	15

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

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:

1. Explain the significance of plants in human nutrition.
2. List out different plant products used by human beings.
3. Evaluate the commercial plant products and their utilization
4. Discuss the uses of medicinal and aromatic plants for human health care.
5. Appraise the importance of timber and non-timber products for value added products.

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 **8 Hrs.**

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 **9 Hrs.**

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.

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.

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.

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II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 11: Plant Resources and Utilization

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Characterize various plant products based on morphological and microscopic observations.
2. Identify economically valuable plants and their products.
3. Categorize distinct plant products utilized by humans.

II. 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.

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II Year B.Sc. HONOURS BOTANY
Practical Examinations at IV Semester
Model Paper

Course 11: Plant Resources and Utilization
(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

1. 1. **(A)** Study of morphology and micro-chemical test for stored material of given food crops. **12m**

2. **(B)** Study of morphology and microscopic study anatomy of given plant fibres **10m**

3.(C). Study of given oil yielding crops and properties of their oils. **5m**

3. Identify the given Spotters and justify the characters. **3X 5= 15m**

D- dye yielding plants

E- resin yielding plants

F- tannin yielding plants

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 11: Plant Resources and Utilization

QUESTION BANK

UNIT-1: Food plants

ESSAY QUESTIONS:-

1. Write an essay on Cultivation, production, and uses of Rice.
2. Write an essay on Cultivation, production, and uses of Wheat.
3. Write an essay on Cultivation, production, and uses of Jowar.
4. Write an essay on Cultivation, production, and uses of Bajra.
5. Write an essay on Cultivation, production, and uses of Red gram.
6. Write an essay on Cultivation, production, and uses of Black gram.

SHORTS:-

1. Centers of Diversity of Plants.
2. Origin of Crop plants.
3. Production and uses of Foxtail millets.
4. Cultivation methods of Finger Millets.
5. Cultivation and production of Sugar cane.

UNIT-2: Other economic plant products

ESSAY QUESTIONS:-

1. Write a detailed note on oil crops.
2. Write an essay on cultivation and uses of Castor oil produced in India.
3. Write an essay on important major fiber yielding crops in India.
4. Write a note on Cultivation and production of Fruit crops in India.

SHORTS:-

1. Uses of Vegetable oils.
2. Process of Textile production from plant fibers.
3. Latex crops.
4. Economic importance of tanins.
5. Alkaloids.

UNIT-3: Commercial plant products

ESSAY QUESTIONS:-

1. General account and economic potential of spices and condiments.
2. Write an essay on Plant sources and economic importance of beverages.
3. Write a detailed note on Utilization of some important ornamentals.

SHORTS:-

1. Economic importance of flavouring products.
2. Important flowering plants.
3. Economic importance of orchids.
4. Fumitories and masticatories.
5. Narcotics.

UNIT-4: Medicinal and aromatic plant products

ESSAY QUESTIONS:-

1. Detailed note onTraditional and modern uses of some medicinal plants of India.
2. Give an account on Phytochemicals and their potential health benefits.
3. Active compounds in medicinal plants and their pharmacological effects.

SHORTS:-

1. Essential oils and their uses.
2. Aromatic plants in perfumery.
3. Plant based cosmetics.

UNIT-5: Timber products and energy crops

ESSAY QUESTIONS:-

1. Write an essay on Important timber yielding plants of India.
2. Write an essay on Wood materials used in construction and their advantages.
3. Give a brief account on Casuarina in Paper generation.

SHORTS:-

1. Other uses of wood products.
2. Biofuels.
3. Bioplastics.
4. Bamboos in Paper generation.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 11: Plant Resources and Utilization

MODEL PAPER

Max marks - 50
Time – 2 hrs

SECTION -1

Answer any THREE questions from the following questions choosing atleast one from each section **3 X 10= 30 M**

Part –I

1. Write an essay on Cultivation, production, and uses of Wheat.
2. Write a detailed note on oil crops.
3. Write an essay on Plant sources and economic importance of beverages.

Part – II

4. Detailed note onTraditional and modern uses of some medicinal plants of India.
5. Give a brief account on Casuarina in Paper generation.
6. Write an essay on Cultivation, production, and uses of Red gram.

SECTION –II

Answer any FOUR of the following questions **4 X 5 = 20M**

7. Centers of Diversity of Plants.
8. Process of Textile production from plant fibers.
9. Fumitories and masticatories.
10. Aromatic plants in perfumery.
11. Bamboos in Paper generation.
12. Cultivation methods of Finger Millets.
13. Economic importance of orchids.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2025-26)

Course 11: Plant Resources and Utilization

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Unit	Essay Questions 10M	Short Questions 5M	Marks allotted to the module
UNIT-1: Food plants	2	2	30
UNIT-2: Other economic plant products	1	1	15
UNIT-3: Commercial plant products	1	2	20
UNIT-4: Medicinal and aromatic plant products	1	1	15
UNIT-5: Timber products and energy crops	1	1	15

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III B.Sc -Botany / V Semester (W.E.F. 2025-26)

V Semester

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:

1. Sketch the ultra-structural aspects of plant cell and its components.
2. Hypothesise the role of chromosomes in inheritance.
3. Justify the role of genes in inheritance of characters by descent.
4. Correlate the functions of the nucleic acid with their structure.
5. Explain the discoveries led to understand the fine structure of a gene.

III. Syllabus of Theory:

Unit-1: Cell and its organelle **8 Hrs.**

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 **8 Hrs.**

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 **10 Hrs.**

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 **9 Hrs.**

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.

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, 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

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.

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Course 12: Cell Biology and Genetics

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Identify the stages of mitotic and meiotic cell divisions.
2. Infer the structure and functions of nucleic acids.
3. Predict the consequences of a particular genetic condition.

II. 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.

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Time: 2 Hrs. **Max. Marks: 50**

1. **(A)** Prepare a temporary mount of the given material and report any two stages of mitosis. **12m**

2. **(B)** Solve the given Genetic Problem (Dihybrid Cross / 3-point test cross) **10m**

3 (C). Solve the given Genetic Problem (Back cross or Test cross / Monohybrid cross) **5m**

3. Identify the given Spotters and justify the characters. **3X 5= 15m**

D- Cell Organelle

E- Cell Organelle

F- DNA / RNA

5.Record + Viva voce **5+3 = 8m**

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Course 12: Cell Biology and Genetics

QUESTION BANK

UNIT – I: CELL AND ITS ORGANELLES

Essay Questions

S.No	Question
1	Describe the ultra-structure of a plant cell.
2	Explain the ultra-structure of the cell wall.
3	Describe the ultra-structure of the plasma membrane and explain the various theories of its organization.

Short Answer Questions

S.No	Question
1	Differentiate between prokaryotic and eukaryotic cells.
2	Write short notes on the cell theory.
3	Write a note on plastid DNA.
4	Write short notes on functions of mitochondria.

UNIT – II: CHROMOSOMES

Essay Questions

S.No	Question
1	Describe the morphology of a eukaryotic chromosome.
2	Explain structural and numerical chromosomal aberrations.
3	Describe the organization of DNA in a chromosome using nucleosome and solenoid models.

Short Answer Questions

S.No	Question
1	Write a short note on Euchromatin and heterochromatin.
2	Differentiate between karyotype and ideogram.
3	Write short notes on nucleosome structure.

UNIT – III: MENDELIAN AND NON-MENDELIAN GENETICS

Essay Questions

S.No	Question
1	Explain Mendel's laws of inheritance with examples.
2	Explain multiple allelism with plant-based examples.
3	Describe complementary, supplementary, and duplicate gene interactions with examples.
4	Explain linkage and crossing over; describe chromosomal mapping with 2-point and 3-point test cross.

Short Answer Questions

S.No	Question
1	Define incomplete dominance.
2	Give an example of co-dominance.
3	Write a short note on multiple allelism.
4	What is a 3-point test cross?
5	Write a note on maternal inheritance.

UNIT – IV: STRUCTURE AND FUNCTION OF DNA

Essay Questions

S.No	Question
1	Explain the Watson and Crick model of DNA.
2	Describe the semiconservative method of DNA replication.
3	Explain the regulation of gene expression in prokaryotes with reference to the Lac Operon.

Short Answer Questions

S.No	Question
1	Write short notes on mRNA.
2	Define genetic code.
3	Write a short note on Lac Operon.
4	Write a brief account on transcription.

UNIT – V: GENE CONCEPT AND SEX DETERMINATION

Essay Questions

S.No	Question
1	Discuss the evolution of gene concept: classical vs molecular concepts.
2	Explain Cis–Trans complementation test for functional allelism.
3	Describe gene as a unit of function, mutation, and recombination.
4	Explain patterns of sex determination in plants.

Short Answer Questions

S.No	Question
1	Differentiate between classical and molecular concepts of gene.
2	Define functional allelism.
3	What is Hardy-Weinberg law?
4	Write short notes on mutation.

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MODEL PAPER

Max marks - 50
Time – 2 hrs

SECTION -1

Answer any **three** questions from the following questions choosing atleast one from each section **3 X 10= 30 M**

Part –I

S.NO	QUESTION
1	Explain the ultra-structure of the cell wall.
2	Describe the organization of DNA in a chromosome using nucleosome and solenoid models.
3	Explain Mendel's laws of inheritance with examples.

Part – II

S.NO	QUESTION
4	Describe the semiconservative method of DNA replication.
5	Describe gene as a unit of function, mutation, and recombination.
6	Explain linkage and crossing over; describe chromosomal mapping with 2-point and 3-point test cross.

SECTION –II

Answer any **four** of the following questions **4 X 5 = 20M**

S.NO	QUESTION
7	Write short notes on the cell theory.
8	Write a short note on Euchromatin and heterochromatin.
9	Write a short note on multiple allelism.
10	Give an example of co-dominance.
11	Write short notes on mRNA.
12	Define functional allelism.
13	What is Hardy-Weinberg law?

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Course 12: Cell Biology and Genetics

BLUE PRINT

Unit	Essay Questions 10M	Short Questions 5M	Marks allotted to the module
Unit I- CELL AND ITS ORGANELLES	1	1	15
Unit II- CHROMOSOMES	2	1	25
Unit -III- MENDELIAN AND NON-MENDELIAN GENETICS	1	2	20
Unit IV- STRUCTURE AND FUNCTION OF DNA	1	1	15
Unit-V- GENE CONCEPT AND SEX DETERMINATION	1	2	20

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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 plant-water relations.
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:

1. Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
2. Explain the role of minerals in plant nutrition and their deficiency symptoms.
3. Interpret the role of enzymes in plant metabolism.
4. Hypothesis the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
5. Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
6. Evaluate the physiological factors that regulate growth, development and flowering in plants.

III. Syllabus of Theory:

Unit – 1: Plant-Water relations **8 Hrs.**

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 10 Hrs.

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

Unit – 4: Nitrogen and lipid metabolism 9 Hrs.

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

Unit – 5: Plant growth - development 8Hrs.

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.

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, New Central 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
6. 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.

VI. Suggested activities and evaluation method

Unit-1: Activity: Observe and tabulate the water content of different plant parts and justify the importance 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 local markets.

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's presentation 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 the topic 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.

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Course 13: Plant Physiology and Metabolism

Credits -1

I. Course outcomes: On successful completion of this practical course, students shall be able to:

1. Conduct lab and field experiments pertaining to plant physiology.
2. Estimate the quantities and qualitative expressions using experimental results and calculations
3. Interpret the factors responsible for growth and development in plants.

II. 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 a xerophyte.
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 Enzyme concentration.
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.
11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmic streaming.

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Time: 2 Hrs. **Max. Marks: 50**

1. **(A)** Demonstration of amylase enzyme activity and study the effect of substrate and Enzyme concentration. **12m**

2. **(B)** Effect of temperature on membrane permeability by colorimetric method. **10m**

3 (C) Ascent of sap through xylem **5m**

3. Identify the given Spotters and justify the characters. **3X 5= 15m**

D- Anatomy of C3, C4 and CAM leaves

E- Mineral deficiency symptoms

F- Arc-auxonometer

5.Record + Viva voce **5+3 = 8m**

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V Semester

Course 13: Plant Physiology and Metabolism

QUESTION BANK

UNIT – 1 : PLANT WATER RELATIONS

ESSAYS QUESTIONS:-

S.NO	QUESTION
1	Define ascent of sap and explain its theories.
2	Illustate Transpiration? Describe the mechanism of opening and closing of stomata.
3.	Explain mechanism of phloem transport - source-sink relationship

SHORTS:-

S.NO	QUESTION
1	Define Osmosis.
2	Discuss about diffusion and Imbibition.
3	Prepare a short note on water potential.

UNIT – 2 :- MINERAL NUTRITION,ENZYMES AND RESPIRATION

ESSAYS QUESTIONS:-

S.NO	QUESTION
1	Decribe the passive and active absorption of mineral ions absorption.
2	Describe the mechanism of Krebs cycle.
3	Explain the mechanism of electron transport chain.

SHORTS:-

S.NO	QUESTION
1	Describe the mechanism of Enzyme action .
2	Define aerobic and anaerobic respiration
3	Define Chemi-osmotic hypothesis.

UNIT – III :- PHOTOSYNTHESIS AND PHOTORESPIRATION

ESSAYS QUESTIONS:-

S.NO	QUESTION
1	Explain Non-cyclic photophosphorylation.
2	Explain the mechanism of Calvin pathway.(C3 cycle)
3	Describe the mechanism of C4 cycle.

SHORTS:-

S.NO	QUESTION
1	Discuss about photosynthetic pigments.
2	Prepare a short note on Red drop and Emerson enhancement effect
3	Describe CAM pathway

UNIT – IV:- NITROGEN AND LIPID METABOLISM

ESSAYS QUESTIONS:-

S.NO	QUESTION
1	Explain Biological Nitrogen fixation and role of rhizobium bacteria in nodule formation.
2	Explain β-Oxidation of fatty acids.

SHORTS:-

S.NO	QUESTION
1	Prepare a short note on classification of plant lipids.
2	Difference between saturated and unsaturated fatty acids.
3	Explain Glyoxalate cycle.

UNIT – V :- PLANT GROWTH- DEVELOPMENT AND STRESS PHYSIOLOGY

ESSAYS QUESTIONS:-

S.NO	QUESTION
1	Define phytohormones? Explain Biosynthesis and Physiological effects of Auxins and Gibberellins.
2	Explain about Photoperiodism.

SHORTS:-

S.NO	QUESTION
1	Disuss about physiological functions of Ethylene.
2	Prepare a short note on Vernalization.
3	Discuss about Role of Phytochrome in flowering.

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V Semester

Course 13: Plant Physiology and Metabolism

MODEL PAPER

SECTION-A

Answer any **THREE** of the following by choosing atleast one question from each part. Draw neat and labelled diagrams wherever necessary. **3X10=30M**

PART-I

1. Define ascent of sap and explain its theories.
2. Describe the mechanism of Krebs cycle.
3. Explain the mechanism of Calvin pathway.

PART-II

4. Explain the mechanism of electron transport chain.
5. Explain Biological Nitrogen fixation and role of rhizobium bacteria in nodule formation.
6. Define phytohormones? Explain Biosynthesis and Physiological effects of Auxins and Gibberellins.

SECTION-B

Answer any **FOUR** of the following Questions.Draw neat and labelled diagrams whereever necessary. **4X5=20M**

7. Define Osmosis.
8. Define aerobic and anaerobic respiration.
9. Prepare a short note on Red drop and Emerson enhancement effect.
10. Prepare a short note on classification of plant lipids.
11. Disuss about physiological functions of Ethylene.
12. Explain Glyoxalate cycle.
13. Disuss about physiological functions of ABA.

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V Semester

Course 13: Plant Physiology and Metabolism

BLUE PRINT

Unit	Essay Questions 10M	Short Questions 5M	Marks allotted to the module
Unit I-Plant Water Relations	1	1	15
Unit II- Mineral Nutrition, Enzymes and Respiration	2	1	25
Unit -II Photosynthesis and Photorespiration	1	1	15
Unit IV- Nitrogen and Lipid Metabolism	1	2	20
Unit-V- Plant Growth Development Stress Physiology	1	2	20

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V Semester

Course 14 B: Seed Technology

Credits -3

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

1. To understand the factors responsible for seed dormancy and procedures for break-down.
2. To learn the aspects of seed processing and storage.
3. To acquaint with various practices in seed testing and diagnosis of seed borne diseases.

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

1. Explain the causes for seed dormancy and methods to break dormancy.
2. Understand critical concepts of seed processing and seed storage procedures.
3. Acquire skills related to various seed testing methods.
4. Identify seed borne pathogens and prescribe methods to control them.
5. Understand the legislations on seed production and procedure of seed certification.

III. Syllabus of Theory:

Unit - 1: Seed dormancy **8 Hrs.**

1. Seed and grain: Definitions, importance of seed; structure of Dicot and Monocot seed.
2. Role and goals of seed technology; characteristics of quality seed material.
3. Dormancy: Definition, causes for seed dormancy; methods to break seed dormancy.

Unit – 2: Seed processing and storage **10 Hrs.**

1. Principles of seed processing: seed pre-cleaning, precuring, drying, seed extraction; cleaning, grading, pre-storage treatments; bagging and labelling, safety precautions during processing.
2. Seed storage; orthodox and recalcitrant seeds, natural longevity of seeds.
3. Factors affecting longevity in storage; storage conditions, methods and containers.

Unit – 3: Seed testing **10 Hrs.**

1. Definition of seed vigour, viability and longevity; seed sampling and equipment; physical purity analysis.

2. Seed moisture – importance – methods of moisture determination.
3. Seed germination tests using paper, sand or soil – standard germination test; TZ test to determine seed viability; seed health testing.

Unit – 4: Seed borne diseases **10 Hrs.**

1. A brief account of different seed borne diseases and their transmission.
2. Different seed health testing methods for detecting microorganisms.
3. Management of seed borne diseases; seed treatment methods: spraying and dusting.

Unit – 5: Seed certification **7 Hrs.**

1. Objectives - Indian seed Act; seed rules and seed order; new seed policy (1988).
2. Seed Inspector: Duties and responsibilities; classes of seeds, phases of certification standards (i.e., Land requirement, isolation distance) etc.
2. Issue of certificates, tags and sealing; pre and post control check: Genetic purity verification, certification, records and reporting.

IV. Text Books:

1. Sharma G. K. (2012) Seed Science and Technology, Daya Publishing House, New Delhi, India
2. Reddy, M. V. and K. V. Krishna Reddy (2009) Seed Science and Technology: A Comprehensive Manual, BS Publications, Hyderabad, India
3. Lawrence O. Copeland and Miller B. McDonald (2014) Principles of Seed Science and Technology, Springer, New York, USA
4. Agrawal, (2005) Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi

V. Reference Books:

1. Umarani R, Jerlin R, Natarajan N, Masilamani P, Ponnuswamy AS (2006) Experimental Seed Science and Technology, Agrobios, Jodhpur
2. Desai B D 2004. Seeds Hand Book: Processing and Storage, CRC Press
3. Agarwal V K and J B Sinclair 1996, Principles of Seed Pathology, CRC Press

4. Tunwar NS and Singh SN. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
5. McDonald, M.B. and L.O. Copland. 1999. Seed Science and Technology Laboratory Manual, Scientific Publishers, Jodhpur
6. Jagdish Lal and R. C. Saxena (2011) Seed Technology and Seed Pathology, Agrobios (India), Jodhpur, India

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Collection of scientific literature and writing a report on causes for seed dormancy and methods to break down.

Evaluation method: Assessing the overall structure and organization of the report based a pre-determined rubric.

Unit-2: Activity: A critical assignment on factors affecting seeds under storage conditions.

Evaluation method: Assessing the depth of analysis and the originality of ideas presented in the assignment.

Unit-3: Activity: Laboratory experimentation and report preparation on seed germination and viability in some plant species.

Evaluation method: Presentation of report with results, including clear and concise summaries, appropriate visuals (tables, graphs), and effective communication of key findings.

Unit-4: Activity: Collection of diseased seeds, identification of pathogens and presenting a report.

Evaluation method: Judging the appropriateness and effectiveness of the experimental design, selection of variables, and control of confounding factors.

Unit-5: Activity: Group discussion on seed certification process.

Evaluation method: Judging the quality and depth of the content discussed, identifying key ideas, arguments, and supporting evidence.

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Course 14 B: Seed Technology

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Break the seed dormancy using various techniques.
2. Determine seed moisture, seed germination percentage, seed viability and vigour.
3. Identify the seed borne pathogens and prescribe methods to prevent or control them.

II. Laboratory/field exercises:

1. Determination of physical properties of seeds of 3 select local crops (1each from cereals, millets, pulses and oil seeds).
2. Breaking seed dormancy in 3 select local crops.
3. Measurement of seed moisture content by O S W A or moisture meter or oven drying method.
4. Seed germination tests and evaluation.
5. Seed vigour - conductivity test.
6. Accelerated ageing tests.
7. Tetrazolium test.
8. Priming and invigoration treatments for improving germination and vigour.

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Course 14 B: Seed Technology
(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

1.(A) Measurement of seed moisture content by O S W A or moisture meter or oven drying method. **12m**

2.(B) Seed germination tests and evaluation. **10m**

3.(C) Tetrazolium test

4. Identify the given Spotters and justify the characters. **3X 5= 15m**

D- Cereals

E- Millets

F- Pulses

5.Record + Viva voce **5+3 = 8m**

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V Semester

Course 14 B: Seed Technology

QUESTION BANK

UNIT – I: SEED DORMANCY

Essay Questions

S.No	Question
1	External and Internal structure of a Dicot and Monocot Seed.
2	What are the factors causing Seed Dormancy.
3	Give an account of types of Seed Dormancy.
4	Explain various methods of Breaking Dormancy.

Short Answer Questions

S.No	Question
1	Define Seed. What is the importance of Seed?
2	Bring out the difference between seed and grain.
3	What are the benefits of using good quality seed for agriculture?
4	What is the Role of Seed Technology in crop improvement?

UNIT – II: SEED PROCESSING AND STORAGE

Essay Questions

S.No	Question
1	Write an essay on purpose and principles of seed processing.
2	Write an essay on sequence of seed processing operation and requirements.
3	Write an account on Seed extraction.
4	Write an essay on Cleaning of seeds.

Short Answer Questions

S.No	Question
1	Write short notes on General Principles of seed storage.
2	Seed Grading.
3	Write short notes on seed testing equipment.
4	Write notes on Cryopreservation.
5	Write notes on Storage packing.

UNIT – III: SEED TESTING

Essay Questions

S.No	Question
1	Write an essay on Germination test.
2	Write an essay on objectives and factors affecting on seed Vigour test.

3	Define moisture content. Describe various methods of seed moisture determination.
4	Write the advantages and disadvantages of tetrazolium test.

Short Answer Questions

S.No	Question
1	Write short notes on Purity analysis.
2	Write notes on Seed viability.
3	Write short note on seed vigour.
4	Write short notes on seed moisture importance.
5	Explain the procedure of constant temperature oven drying method.
6	Write the procedure for Rolled Paper Towel Test of seed viability.

UNIT – IV: SEED BORNE DISEASES

Essay Questions

S.No	Question
1	What are various seed treatment methods?
2	Give an account of transmission of seed borne diseases.
3	Write an account on Dry Inspection method of seed health testing?
4	Write about Blotter method of seed health testing?

Short Answer Questions

S.No	Question
1	What is Seed Health? What is seed health testing?
2	What are the Objective of seed health testing?
3	Write notes on biological Methods for management of seed borne diseases.

UNIT – V: SEED CERTIFICATION

Essay Questions

S.No	Question
1	Give a brief note on Seed Legislation in India.
2	Write a note on structure of central seed committee and functions as per the 1966 seed Act.
3	Define seed. Describe various types of seeds.
4	Write an essay on New seed policy 1988.
5	Write an account on SEEDS (CONTROL) ORDER, 1983.

Short Answer Questions

S.No	Question
1	Write short notes on Certified Seed and Truthful seed.
2	Write the difference between certified seed and Truthful.
3	Write note on Phases of Seed Certification.
4	Write a note on seed certification controls.
5	Seed Standards of Genetic Purity.
6	Explain Hartmann and Kester suggested steps for Genetic Purity during Seed Production.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc -Botany / V Semester (W.E.F. 2025-26)

Course 14 B: Seed Technology

MODEL PAPER

Max marks - 50

Time – 2 hrs

SECTION -1

Answer any **three** questions from the following questions choosing atleast one from each section **3 X 10= 30 M**

Part –I

S.NO	QUESTION
1	What are the factors causing Seed Dormancy.
2	Write an essay on sequence of seed processing operation and requirements.
3	Write an essay on Germination test.

Part – II

S.NO	QUESTION
4	Write a note on structure of central seed committee and functions as per the 1966 seed Act.
5	Write an essay on New seed policy 1988.
6	Write an essay on Cleaning of seeds.

SECTION –II

Answer any **four** of the following questions **4 X 5 = 20M**

S.NO	QUESTION
7	Bring out the difference between seed and grain.
8	Write short notes on seed testing equipment.
9	Explain the procedure of constant temperature oven drying method.
10	What is Seed Health? What is seed health testing?
11	What are the Objective of seed health testing?
12	Write a note on seed certification controls.
13	Seed Standards of Genetic Purity.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III B.Sc -Botany / V Semester (W.E.F. 2025-26)

V Semester

Course 14 B: Seed Technology

BLUE PRINT

Unit	Essay Questions 10M	Short Questions 5M	Marks allotted to the module
Unit I- SEED DORMANCY	1	1	15
Unit II- SEED PROCESSING AND STORAGE	2	1	25
Unit -III- SEED TESTING	1	1	15
Unit IV- SEED BORNE DISEASES	1	2	20
Unit-V- SEED CERTIFICATION	1	2	20

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III B.Sc -Botany / V Semester (W.E.F. 2025-26)

V Semester

Course 15 A: Mushroom Culture Technology

Credits -3

I. 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 edible mushrooms.

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

1. Understand the structure and life of a mushroom and discriminate edible and poisonous mushrooms.
2. Identify the basic infrastructure to establish a mushroom culture unit.
3. Demonstrate skills preparation of compost and spawn.
4. Acquire a critical knowledge on cultivation of some edible mushrooms.
5. Explain the methods of storage, preparation of value-added products and marketing.

III. 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 **9 Hrs.**

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 for compost preparation.
3. Methods of composting- long method of composting and short method of composting.

Unit – 3: Spawning and casing **10 Hrs.**

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 of spawn.
3. Casing: Definition, Importance of casing mixture, Quality parameters of casing soil, different types of casing mixtures, commonly used materials.

Unit – 4: Mushroom cultivation **10 Hrs.**

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

Unit – 5: Post harvest technology **8 Hrs.**

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

IV. Text Books:

1. Tavis Lynch (2020) Mushroom Cultivation: An Illustrated Guide to Growing Your Own Mushrooms at Home, Rockridge Press, Emeryville, California, USA
2. Chang, P. and C. P. Bhatnagar (2003) Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact, CRC Press, Boca Raton, Florida, USA

3. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
4. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.

V. Reference Books:

1. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
2. Pandey R.K, S. K Ghosh, (1996). A Hand Book on Mushroom Cultivation. Emkey Publications
3. Nita Bhal. (2000). Handbook on Mushrooms (Vol. I and II). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Pathak V.N., Nagendra Yadav and Maneesha Gaur (2000), Mushroom Production and Processing Technology Vedams Ebooks Pvt. Ltd., New Delhi
5. Rattan, S.S. and R.C. Upadhyay (2006) Mushroom Production Technology: Recent Advances, Daya Publishing House, Delhi, India

VI. 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 on identification of key issues, analysis, and synthesis of information.

Unit-5: Activity: A survey report on market demand and consumer preferences for mushrooms and 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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III B.Sc -Botany / V Semester (W.E.F. 2025-26)

V Semester

Course 15 A: Mushroom Culture Technology

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Identify and discriminate different mushrooms based on morphology.
2. Understand facilities required for mushroom cultivation.
3. Demonstrate skills on preparation of spawn, compost and casing material.
4. Exhibit skills on various cultivation practices for an edible mushroom.

II. 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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
II Year B.Sc. HONOURS BOTANY
Practical Examinations at V Semester
Model Paper

Course 15 A: Mushroom Culture Technology

(2025-26)

Time: 2 Hrs. **Max. Marks: 50**

1.(A) Preparation of pure culture of an edible mushroom **12m**

2.(B) Demonstration of spawning and casing. **10m**

3.(C) Demonstration of storage methods

4. Identify the given Spotters and justify the characters. **3X 5= 15m**

D- Edible Mushroom

E- Poisonous Mushroom

F- Value added product

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III B.Sc -Botany / V Semester (W.E.F. 2025-26)
V Semester

Course 15 A: Mushroom Culture Technology
QUESTION BANK

UNIT I - INTRODUCTION AND VALUE OF MUSHROOM
ESSAY QUESTIONS

S.N O	QUESTION
1	Discuss briefly the life cycle of Mushroom.
2	Describe morphological features of an edible mushroom.
3	Illustrate the nutraceutical and medicinal values of mushrooms in India.

SHORT QUESTIONS

S.N O	QUESTION
1	Differentiate edible and poisonous mushrooms
2	Interpret the poisonous mushrooms and their harmful effects
3	Explain about *Pleurotus florida* .

UNIT II -BASIC REQUIREMENTS OF CULTIVATION SYSTEM
ESSAY QUESTIONS

S.N O	QUESTION
1	Describe the design for smaller and larger commercial unit of mushroom
2	List the machinery required for compost making
3	Explain the methods of composting

SHORT QUESTIONS

S.N O	QUESTION
1	List the materials required for compost preparation and add note
2	Infer the factors affecting composting
3	Define and explain pasteurization tunnel

UNIT III - SPAWNING AND CASING
ESSAY QUESTIONS

S.N O	QUESTION
1	Define spawn and list the facilities required for spawning
2	Discuss different types of substrates used for preparation of spawn
3	Explain about casing

SHORT QUESTIONS

S.N O	QUESTION
1	Summarize the characteristics of a good casing soil
2	Describe the preparation of spawn substrate
3	Explain the preparation of pure culture

UNIT IV - MUSHROOM CULTIVATION

ESSAY QUESTIONS

S.N O	QUESTION
1	Explain the process of cultivation of milky mushroom
2	Explain the process of cultivation of button mushroom
3	Discuss the common weed molds that cause damage to mushroom cultivation

SHORT QUESTIONS

S.N O	QUESTION
1	Discuss the post harvest management in button mushroom
2	List the major diseases of mushrooms
3	Describe any two methods of packaging button mushroom

UNIT V- POST HARVEST TECHNOLOGY

ESSAY QUESTIONS

S.N O	QUESTION
1	Discuss the preservation of mushroom
2	Explain various ways of management of spent substrate and waste disposal of various mushrooms
3	Explain the quality assurance and entrepreneurship in mushroom cultivation

SHORT QUESTIONS

S.N O	QUESTION
1	Explain canning of mushroom
2	Describe the self life of mushroom
3	List economic importance of mushroom
4	Discuss value added products of mushroom

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

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V Semester

Course 15 A: Mushroom Culture Technology

MODEL PAPER

Max marks - 50
Time – 2 hrs

SECTION -1

Answer any **three** questions from the following questions choosing atleast one from each section **3 X 10= 30 M**

Part –I

S.NO	QUESTION
1	Discuss briefly the life cycle of Mushroom.
2	Describe the design for smaller and larger commercial unit of mushroom
3	Define spawn and list the facilities required for spawning

Part – II

S.NO	QUESTION
4	Explain the process of cultivation of milky mushroom
5	Discuss the preservation of mushroom
6	Describe morphological features of an edible mushroom.

SECTION –II

Answer any **four** of the following questions **4 X 5 = 20M**

S.NO	QUESTION
7	Differentiate edible and poisonous mushrooms
8	List the materials required for compost preparation and add note
9	Summarize the characteristics of a good casing soil
10	Describe the preparation of spawn substrate
11	Discuss the post harvest management in button mushroom
12	Explain canning of mushroom
13	Describe the self life of mushroom

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III B.Sc -Botany / V Semester (W.E.F. 2025-26)

V Semester

Course 15 A: Mushroom Culture Technology

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UNIT	TITLE	ESSAY	SHORT	MARKS ALLOTED
I	INTRODUCTION AND VALUE OF MUSHROOM	2	1	25
II	BASIC REQUIREMENTS OF CULTIVATION SYSTEM	1	1	15
III	SPAWNING AND CASING	1	2	20
IV	MUSHROOM CULTIVATION	1	1	15
V	POST HARVEST TECHNOLOGY	1	2	20
	TOTAL			**95**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Honours -Botany-Major / I Semester (W.E.F. 2025-26)

PRINCIPLES OF BIOLOGICAL SCIENCES

MULTI DISCIPLINARY COURSE IN I SEMESTER

SYLLABUS

Credits : 2 2 hrs/week

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

1. Acquire logic to evaluate fundamental biological concepts at various levels of biological organisation including the molecular, cellular, organismal and systems levels.
2. Communicate fundamental biological knowledge between tiers of biological organisation.
3. Apply common biological principles across all levels of biological organization.

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

1. Understand the relationship between structure and function at all levels.
2. Recognise the mechanisms underlying biological evolution, its patterns, and its significance as biology's overarching unifying principle.
3. Understand the contributions of biology to the resolution of medical, ethical, social, and environmental concerns in human affairs.

UNIT-I Diversity of Life

1.1 Introduction to Biology, Branches of Biology, Basic Principles of Biology
1.2 Biological Classification-Two kingdom and Five kingdom classification, Viruses, Viroid'sand Lichens
1.3 Diversity in the living world, Taxonomic categories, Taxonomic aids
1.4 Plant organization-The form, structure and function of plant vegetative and reproductive organs, Classification of Plant Kingdom,
1.5 Basis of Animal Classification, Classification of Animal Kingdom

UNIT-II Biomolecules and metabolism

2.1 Ultra structure of cell and Cell organelles (Structure and Functions), Plant cell vs Animalcell
2.2 Plant Physiology: Photosynthesis, Respiration, Transportation, Mechanisms of Nitrogen fixation.
2.3 Plant growth and development, physiology of flowering.
2.4 Human Physiology: Digestion, Respiration, Circulation
2.5 Male and female reproductive organs, gametogenesis, fertilization.

UNIT-III Principles of Biology

3.1 Genetics: Mendel's laws of inheritance, Genetic disorders- Colour blindness, Sickle cell anaemia.

3.2 Evolution: Geological time scale for evolution of plants and vertebrates, Origin and evolution of plants and man

3.3 Common Human Diseases: causing organism, prevention and treatment- malaria, dengue, AIDS, cancer, corona.

3.4 Common Plant Diseases: causing organism, prevention and treatment- Black spot, Leafspots, Powdery mildew, Blight, Canker.

3.5 Biotechnology: Tools and process of recombinant DNA technology, Applications of biotechnology in agriculture, food industry, medicine and transgenic animals.

Text Books

1. Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi.
2. Kotpal, R.L.2022. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut).
3. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolutionand Ecology. S. Chand publishers, New Delhi, India.

Reference Books

1. Sreekrishna V. 2005. Biotechnology –I, Cell Biology and Genetics. New Age International Publ. New Delhi, India.
2. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.

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I Honours -Botany-Major / I Semester (W.E.F. 2025-26)

PRINCIPLES OF BIOLOGICAL SCIENCES

MULTI DISCIPLINARY COURSE IN I SEMESTER

QUESTION BANK

UNIT I – DIVERSITY OF LIFE

ESSAY QUESTIONS:-

S.NO	QUESTION
1.	Define biology and explain about the basic principles and Branches of biology?
2	Explain about the structure and function of plant vegetative organs

SHORTS

S.NO	QUESTION
1.	Define Taxonomic categories
2.	Prepare ashort note on taxonomic aids

UNIT II BIOMOLECULES AND METABOLISM

ESSAY QUESTIONS:-

S.NO	QUESTION
1.	Describe the process of photosynthesis.
2	Tell about the mechanism of nitrogen fixation

SHORTS

S.NO	QUESTION
1.	Distinguish between plant cell and animal cell
2.	Explain about the phases of plant growth

UNIT III – PRINCIPLES OF BIOLOGY

ESSAY QUESTIONS:-

S.NO	QUESTION
1.	Explain the applications of biotechnology in various fields?
2.	Discuss the common diseases in plants.(Powdery mildew,,Blight ,Canker , Blackspot)

SHORTS

S.NO	QUESTION
1.	Explain the tools involved in R-DNA technology

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Honours -Botany-Major / I Semester (W.E.F. 2025-26)

PRINCIPLES OF BIOLOGICAL SCIENCES

MULTI DISCIPLINARY COURSE IN I SEMESTER

MODEL PAPER

Time:2hrs
Max.Marks:50M

Answer any THREE of the following questions **3X10=30**

SECTION- A

1 . Define biology and explain about the basic principles and Branches of biology?

2. _____.

3. Describe the process of photosynthesis

4. _____.

5 Explain the applications of biotechnology in various fields?

SECTION- B

Answer any FOUR of the following questions **4X5=20**

6. _____.

7.

8. Define Taxonomic categories

9.

_____.

10. Distinguish between plant cell and animal cell

11. _____.

12. Explain the tools involved in R-DNA technology

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Honours -Botany-Major / I Semester (W.E.F. 2025-26)

PRINCIPLES OF BIOLOGICAL SCIENCES

MULTI DISCIPLINARY COURSE IN I SEMESTER

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MARKS	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
MODULE – I	01	01	15
MODULE – II	01	01	15
MODULE – III	01	01	15
Total no.of Questions	03	03	45

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III Honours -Botany-Major / V Semester (W.E.F. 2025-26)

COMMON VALUE-ADDED COURSE

ENVIRONMENTAL EDUCATION

Credits: 2 2 hrs/week

Course objective: A Generic Course intended to create awareness that the life of human beings is an integral part of environment and to inculcate the skills required to protect environment from all sides.

Learning outcomes: On completion of this course the students will be able to

1. Understand the nature, components of an ecosystem and that humans are an integral part of nature.
2. Realize the importance of environment, the goods and services of a healthy biodiversity, dependence of humans on environment.
3. Evaluate the ways and ill effects of destruction of environment, population explosion on ecosystems and global problems consequent to anthropogenic activities.
4. Discuss the laws/ acts made by government to prevent pollution, to protect biodiversity and environment as a whole.
5. Acquaint with international agreements and national movements, and realize citizen's role in protecting environment and nature.

Unit 1: Environment and Natural Resources 06 Hrs.

1. Multidisciplinary nature of environmental education; scope and importance.
2. Man as an integral product and part of the Nature.
3. A brief account of land, forest and waterresources in India and their importance.
4. Biodiversity : Definition; importance of Biodiversity - ecological,consumptive, productive, social, ethical and moral, aesthetic, and option value.
5. Levels of Biodiversity: genetic, species and ecosystem diversity.

Unit-2: Environmental degradation and impacts 10Hrs

1. Human population growth and its impacts on environment; land use change, land degradation, soil erosion and desertification.
2. Use and over-exploitation of surface and ground water, construction of dams, floods, conflicts over water (within India).
3. Deforestation: Causes and effects due to expansion of agriculture, firewood, mining, forest fires and building of new habitats.
4. Non-renewable energy resources, their utilization and influences.
5. A brief account of air, water, soil and noise pollutions; Biological, industrial and solid wastes in urban areas. Human health and economic risks.
6. Green house effect - global warming; ocean acidification, ozone layer depletion, acid rains and impacts on human communities and agriculture.
7. Threats to biodiversity: Natural calamities, habitat destruction and fragmentation, over exploitation, hunting and poaching, introduction of exotic species, pollution, predator and pest control.

Unit 3: Conservation of Environment 10 Hrs

1. Concept of sustainability and sustainable development with judicious use of land, water and forest resources; afforestation.
2. Control measures for various types of pollution; use of renewable and alternate sources of energy.
3. Solid waste management: Control measures of urban and industrial waste.
4. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
5. Environment Laws: Environment Protection Act; Act; Wildlife Protection Act; Forest Conservation Act.
6. International agreements: Montreal and Kyoto protocols; Environmental movements: Bishnois of Rajasthan, Chipko, Silent valley.

Suggested activities to learner: (4 hours)

1. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc
2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural site.
3. Study of common plants, insects, birds and basic principles of identification.
4. Study of simple ecosystems-forest, tank, pond, lake,mangroves etc.
5. Case study of a Forest ecosystem or a pond ecosystem.

Suggested text book :

- ErachBarucha (2004) *Text book of Environmental Studies for Undergraduate courses* (Prepared for University Grants Commmission) Universities Press.
- PurnimaSmarath (2018) *Environmental studies* Kalyani Publishers, Ludhiana

Reference books :

- Odum, E.P., Odum, H.T. & Andrews, J. (1971) *Fundamentals of Ecology*. Philadelphia:Saunders.
- Pepper, I.L., Gerba, C.P. &Brusseau, M.L. (2011). *Environmental and Pollution Science*.Academic Press.
- Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012) *Environment. 8th edition*. JohnWiley & Sons.
- Singh, J.S., Singh, S.P. and Gupta, S.R. (2014) *Ecology, Environmental Science and Conservation.* S. Chand Publishing, New Delhi.
- Sengupta, R. (2003) Ecology and economics: An approach to sustainable development.OUP.
- Wilson, E. O. (2006) *The Creation: An appeal to save life on earth.* New York: Norton.
- Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll (2006) *Principles of Conservation Biology.* Sunderland: Sinauer Associates

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III Honours -Botany-Major / V Semester (W.E.F. 2025-26)

COMMON VALUE-ADDED COURSE

ENVIRONMENTAL EDUCATION
Model Paper

Time :2 hrs

Max Marks: 50

SECTION - A **(4x5=20 marks)**

Answer any **four** question. Each question carries 5 marks

1. Explain about the water resources and their use in daily life.
2. Describe about Green house effect.
3. Write briefly about the soil pollution.
4. Chipko Movement and Silent valley movements.
5. Define deforestation and explain causes of deforestation .
6. Describe Wild life protection Act.
7. What is Insitu conservation of biodiversity?
8. What are Biological, industrial and solid waste in urban areas?

SECTION B **(3x10=30 marks)**

Answer any **three** questions. Each question carries 10 marks

9. Define Biodiversity and explain value of biodiversity.

(or)

10 Explain about the forest resources and their importance.

11. Discuss about Human Population growth and its impacts on environment.

(or)

12. Write an essay on Air Pollution.
13. Write an essay on Water Pollution.

(or)

14. Discuss concept of Sustainability and Sustainable development with judicious use of land, water and forest resources.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
III Honours -Botany-Major / V Semester (W.E.F. 2025-26)

COMMON VALUE-ADDED COURSE

ENVIRONMENTAL EDUCATION

QUESTION BANK

UNIT-1

ESSAY QUESTIONS

1.Define environmental education .write the scope and importance of the environmental education.

2.Explain multi disciplinary nature of the environmental education.

3.Man is an integral product and part of the nature –justify the statement.

4.Define resources and give an account of land resources and importance.

5.Explain about the water resources and their use in our daily life.

6.Describe about the over –exploitation of water.

7.Define deforestation .Explain causes and effects of deforestation.

8.Define the biodiversity. Explain the value of biodiversity.

9.write a note on biodiversity hotspots.

SHORT ANSWER QUESTIONS

1. Scope and importance of environmental education.

2.Biodiversity definition and importance.

3. Soil erosion and causes for for soil erosion.

4. Land degradation and control of degradation.

5. write a short note on Water cycle.

6. Deforestation.

7. write short note on chipko movement.

8. Jhum or podu cultivation.

9.Forest mining.

10.What are the different types of biodiversities.

UNIT-2

ESSAY QUESTION

1.Discuss about human population growth and its impacts on environment.

2.Write an essay on the use and over – exploitation of surface and ground water.

3.Write about renewable and non –renewable energy resources ,their utilization and influences.

4.what is pollution give a brief account of air ,water ,soil and noise pollutions.

5.Define deforestation .Explain causes and effects of deforestation.

6.write an essay on biological,industrial and solid waste in urban areas.

7.write an essay on global warmimg.

8. what is green house effect.

9 .write an essay on threats to biodiversity.

SHORT ANSWER QUESTIONS

10.Population growth and its impact on environment.

11.Conflicts over water.

12.Construction of dams benefits and problems.

13.Depletion of ozone layer.

14. Eutrofication.

15. Biomagnification.

16. soil pollution.

17.water pollution.

18. Air pollution.

19. Noise pollution.

20. biological waste.

21 .Industrial and solid wastes in urban area.

22. Global warming.

23. Natural calamities or disasters.

UNIT-3

ESSAY QUESTIONS

1. Discuss concept of sustainability and sustainable development with judicious use of land ,water,forest resources.

2.write an essay on in-situ and ex-situ conservation of biodervisity.

3. Expalin the environmental protection act 1986.

4.What are the salient features of forest conservation 1980.

SHORT ANSWER QUESTIONS

5.Ex-situ conservation.

6.Forest conservation 1980.

7 . Wild life protection act 1972.

8 .Write a short note on montreal protocol.

9. Write a short note on Kyoto protocol.

10. Write a short note on bishinois of rajasthan.

11. Write a short note on sailent valley movement.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

CERTIFICATE COURSE FOR BOTANY

TITLE : HEALTH CARE BY LOCAL MEDICINAL PLANTS (HLMP)

2025-26

For I, II & III Years

Total Hours : 45 Hours **Credits : 2**

Department of Botany will be going to conduct 45 days certificate course in the academic year 2025-26. Certificate issued after completion of the course (assessment necessary for certificate)

Purpose of the course or course out comes :

To equip students with knowledge and practical skills in identifying, propagating, conserving, and utilizing local medicinal plants for primary health care and sustainable resource management.

1) Qualifications : Degree on going.

2) Course : Health care by Local Medicinal Plants (HLMP).

3) Medium : English.

4) Course duration : 45 hrs.

5) Instructional hrs. (teaching) : 1hr per day.

6) Instructional hrs timings : 4pm to 5pm.

7) Mode of instructins : off line and online.

8) Final assessment : offline or online exam, exam date announced later.

9) Instructors : Dr.Ch. John Samuel.

10) Fee : Exam fee Rs 300/-

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

(W.E.F. 2025-26)

CERTIFICATE COURSE

Total hours of instructions and practicals - 45

HEALTH CARE BY LOCAL MEDICINAL PLANTS (HLMP)

SYLLABUS

Unit I – Introduction to Local Medicinal Plants & Ethnobotany - 9 HRS

Concept and scope of ethnobotany, Importance of medicinal plants in primary health care, Overview of medicinal plant diversity in the local region, Role of WHO in promoting traditional medicine

Unit II – Identification & Botanical Description of Selected Local Medicinal Plants

Morphological and taxonomic features for identification, Common families with medicinal value in the locality, Field identification techniques, Local vernacular names vs. scientific names.

Unit III – Propagation and Conservation of Local Medicinal Plants - 9 HRS

Propagation Methods: Sexual propagation (seed collection, treatment, sowing, nursery techniques), Asexual propagation (cuttings, layering, grafting, micropropagation)

Conservation Techniques: In-situ conservation (sacred groves, medicinal plant gardens, protected areas), Ex-situ conservation (botanical gardens, seed banks, tissue culture), Cultivation practices for selected medicinal plants.

Unit IV – Applications in Primary Health Care - 9 HRS

Home remedies and formulations from local medicinal plants (decoctions, infusions, poultices, powders), Role of medicinal plants in treatment of common ailments (cold, cough, fever, skin problems, digestive issues, wounds), Safety, dosage, and toxicity considerations

Unit V – Hands on Practice - 9 HRS

1. **Herbarium Preparation.**
2. **Demonstration of Propagation Techniques**:- Seed germination, nursery bed preparation, stem cuttings, and layering methods
3. **Formulation of Simple Herbal Remedies**:- Preparation of herbal tea, ointment, decoction, or oil using local medicinal plants.

Field visit (with your own expenses) 1 Day

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

The **Board of Studies in BOTANY** for the academic year 2025-2026 held on 07-08-2025 in Dept. of Botany.

AGENDA:

The board of studies of a department in the college shall

1. Adapting APSCHE syllabus for all Semesters
2. Adapting 50 Marks for External evaluation and 50Marks for Internal evaluation for all Semesters, 100 marks for Community service project at the end of II semester, 100 marks for Short internship at the end of IV semester, 200 marks for complete Internship at the end of VI Semesters.
3. Conduct of Semester End Practical examinations for I, II, & III Years.
4. Approval of Model question papers and Blue print for I, II & III years.
5. Approval of conversion of teaching method for some practical oriented topics through audio & video visuals
6. Approval of student online courses including faculty for the year 2025-26.
7. Approval of I, II, & III Years I, II, III, IV & V semesters syllabus with theory and Practical will be finalized by following APSCHE.
8. Approval of NPTEL courses to all Botany students.
9. Approval to introduce Certificate course for I, II, & III Years.
10. Finalizing the list of question paper setters and Examiners.

The members of B.O.S in Botany discussed all the issues kept in agenda at length and taken following resolutions.

RESOLUTIONS:

1. The Chairperson submitted the syllabus for Botany which was adopted from the APSCHE for the Academic year 2025-26.
2. Resolved I, II, III Years- I, II, III, IV & V Semesters syllabus with theory and Practical was finalized by following APSCHE guidelines.
3. Resolved to adopt 50 marks for External, 50 marks for Internal evaluations for all I, II & III Years students, 100 marks for Community service project at the end of II semester, 100 marks for Short internship at the end of IV semester, 200 marks for complete Internship at the end of VI Semesters.
4. Resolved to conduct Semester end examinations for all semesters.
5. Resolved to introduce Certificate Course to all Students with 2 Credits.
6. Resolved to conduct offline exam for Certificate course and certificates will be provided to their respective mails.
7. Resolved to introduce Moocs courses in NPTEL Platform useful for their future career and higher studies as well.
8. Resolved to Finalize the Model question papers and Blue print for I, II & III years.
9. Resolved to Finalize the list of question paper setters and Examiners.

The BOS Committee Members in the **BOTANY** BOS Meeting has resolved the following members to act as the examiners for both paper setting and paper evaluation.

S.No	Name of the examiner	Location of Examiner	EMAIL ID	Mobile number
1	Dr. A. Srinivas Rao	Govt Arts College, Rajahmundry	drasr.botany@gcrjy.ac.in	9985076306
2	K.V.V.G.K Vara Prasad	Government Degree College, Tuni	kvgkvaraprasad@gdctuni.edu.in	9908876727
3	Dr. M. Sulakshana	A S D Womens Degree College, Kakinada	sulakshanabotany@gmail.com	7997633870
4	K.N.V S N Eswari	A S D Womens Degree College, Kakinada	knvsneswari.3@gmail.com	9948899093
5	Dr.P.Prayaga Murthy	GDC YELESWARAM	pragada007@gmail.com	9885852068
6	P.JANAKI RAM	GDC PERUMALLAPURAM	janakiraopujari57@gmail.com	9490649732
7	Mr.K.Gani Raju	Govt Arts College, Rajahmundry	ganirajukota83@gcrjy.ac.in	9948088250
8	Dr.K.Nagendra Prasad	Govt Arts College, Rajahmundry	nagendrabotany@gcrjy.ac.in	7013545164
9	Mr.N.Nageswara Rao	Govt Arts College, Rajahmundry	nnrbotany1971@gmail.com	8309832595
10	Smt.M.Satyaveni	Govt Arts College, Rajahmundry	satyavenisk@gmail.com	9493990914
11	Smt.K.Usha Sri	Government Degree College, Pithapuram	myduushasri@gmail.com	9441158594

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Faculty members:

1.Dr. M.KRISHNA RAO
Lecturer in Botany
PRGC(A), Kakinada

Student Members:

1.N.Abhitha - III Hons Botany

2.B.A.N.V.D.Savithri - III Hons Botany

3. N.Meghana - II Hons Botany