

# **BOARD OF STUDIES IN B.Sc BOTANY**

**2022-2023**

**DEPARTMENT OF BOTANY**

**SYLLABUS FOR B.Sc BOTANY**



**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 (AUTONOMOUS), KAKINADA,

Department of Botany

The Board of Studies meeting for Botany subject during the academic year 2022-2023 is conducted at the Dept. of Botany on November 2022 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 SAMUEL  
Lecturer in-Charge  
Dept. of Botany  
PRGC(A),  
Kakinada

2. Adi Kavi Nannava University

Nominee: Dr. J. SUNITHA,  
Principal  
GDC Kovvur  
Mobile: 9441050910  
E-mail: drjsuneetha@gcrjy.ac.in

3. Members Nominated by Executive Council of the College:

a. Subject Expert 1:

Mrs. KNVSN Eswari  
Lecturer in Botany  
ASDGDC for Women(A)  
Kakinada.  
9948899093

b. Subject Expert 2:

Dr. G. JYOTHIRMAYEE  
Lecturer in Botany  
SRVBSJB M.R  
College, Peddapuram  
7989171117  
E-mail: drgjbotanymr@gmail.com

c. Member from Research Organization:

Smt P. SWATHI  
Assistant Director,  
Biological Control Laboratory  
Dept. of Agriculture, Kakinada  
Mobile: 9848350962  
E-Mail: swathi3002@yahoo.com

Name, Designation and Address

Signature

d. Alumni Member:

**Dr. D R SALOMI SUNEETHA**  
Professor & Head  
Plant Physiology, Biochemistry & Microbiology Dept.  
College of Horticulture  
Dr YSR Horticultural University  
Venkatramannagudem-534101 W.G Dist  
Mobile: 9491608088  
Email: salomibiochem@gmail.com

4. Members from the College:

a. Faculty member:

1. **Dr. Ch. JOHN SAMUEL**

Lecturer in-Charge  
Dept. of Botany  
PRGC(A), Kakinada

2. **Smt. SARAPALAPARTHY**

Lecturer in Botany  
PRGC(A), Kakinada

3. **Dr. M. KRISHNA RAO**

Lecturer in Botany  
PRGC(A), Kakinada

b. Student members:

1. **Mr. P. ABHISHEK NAGESWARA RAO**

II B.Z.C.SEC-II

2. **Miss. D. Satya**

II B.Z.C.SEC-I

## PEDAGOGY

Commissionerate of Collegiate Education, AP, Vijayawada

Development of Unit-wise Pedagogy for Conventional Subjects under CBCS

### Broad Guidelines and Models

Pedagogy is a set of diverse teaching or instructional strategies and methods used by the teacher in an educational institution to facilitate effective learning by students. Diverse methods are used because learning is dependent on multiple ways but not on any one method such as lecturing. There is no single, universal approach that suits all situations

Pedagogy is the art and science of teaching. Different strategies used in different combinations with different groupings of students will ensure learning outcomes. Some strategies for teaching certain skills and fields of knowledge are more appropriate than the others. Some approaches are better suited to certain student backgrounds, learning styles and abilities. Effective pedagogical practice promotes the wellbeing of students, teachers and the community - it improves students' and teachers' confidence and contributes to their sense of purpose for being at college.

Although it is the privilege of the teacher to choose or design his/her own pedagogical methods it is also his/her responsibility to ensure proper learning by all students in the class. A few pedagogical methods designed and implemented in the last several decades remain time-tested and popular across the world. The effectiveness of ICT and other educational technologies as a support to pedagogy in the recent years was found to be immense.

The following are some of the pedagogical methods commonly practiced. They are given Pedagogical Strategy or method (PS) Numbers for common use in academic and teaching plans.

- I **Common Strategies:** Common pedagogical strategies suggested to be used for preparing teaching plan (preferably in circles and matrices) for each unit of subject syllabus.

Table-1:

<i>Sno</i>	<i>PS</i>	<i>Pedagogic Strategy/Method</i>	<i>Practice</i>	<i>Advantages</i>
1	P <sub>1</sub>	Lecture	Continuous teaching by a teacher to a large number of students for about one hour	Useful in transmitting organized knowledge in a systematic way
2	P <sub>2</sub>	Demonstration	Showing a process with the help of real, dummy or simulated material	Applied for learning a practical aspect along with skills
3	P <sub>3</sub>	Question & Answer	Teacher asks questions before, during or after lecture or demo	Feedback on student level of understanding. Useful in assessing teacher's own progress.
4	P <sub>4</sub>	Discussion, Debate or Collaboration	Student activity after the lecture, video or other teacher activity. Small groups (Pair-learning: with two students) to large groups.	Spreads knowledge and ideas in students under group learning and consolidates basic learning. Communication skills are inculcated.

5	P <sub>5</sub>	Audio & Video	Play ready-made or teacher made audio/video on the topic	Brings in external expertise and better understanding through visuals or animations
6	P <sub>6</sub>	Virtual or Online learning	Students work with computer simulated models and processes. Stored or online. Learning directly through internet utilizing standard resources	Well crafted three dimensional models and processes give inside information and real time feelings. Access to vast and highly qualitative learning resources on the internet. A computer skill is inculcated.
7	P <sub>7</sub>	Assignment or Case Study	Easy, medium and critical assignments include compiling of information from standard books to preparing creative solutions and models to problems	Independent learning, critical thinking, judging and creativity are promoted. Writing skills are enhanced.
8	P <sub>8</sub>	Study (Research) Project	Students undertake a local problem and make research study on it towards its solution or betterment	Inculcates habit of learning by research. Trains in traits such as identifying problem, survey, collecting compiling and analyzing of information, drawing conclusions, report writing etc. Spoken and written communication skills are enhanced.
9	P <sub>9</sub>	Hands on Study	Students work in a field, industry, organization or under a professional for covering especially a practical part of syllabus	Provides on real time experience to students. Gives professional training. Trained in job/work skills.
10	P <sub>10</sub>	Class Seminar	Student teaches a part of the unit as a supplement to the lecturer	Student independent learning will be consolidated and inculcates such traits as comprehension, teaching skills, interaction , public speaking etc. . Communication skills are enhanced.

- II. **Test:** Teaching learning every Unit shall end with a test. This can be denoted as **P<sub>T</sub>** . Test can be used not only as an assessment and measurement tool but also as an effective learning strategy. Questions shall be designed in such a way that the student needs to learn in several dimensions from test to test to answer the questions.

III. **Additional Strategies:** Fifteen more Additional Strategies are given in Table -2. These may be employed by the individual Lecturer based on the subject, unit, classroom situation etc. The teacher may mark **Px** for any of these additional strategies in the teaching plans, cycles and matrices.

Table-2:

<i>Sno</i>	<i>Pedagogic Strategy/Method</i>	<i>Practice</i>	<i>Advantages</i>
1	Quiz	Small student teams compete to answer random questions from the quiz master	Best used for extracting precise but dispersed information
2	Brainstorming	A small or large group of students gather their ideas on new concepts or aspects	Useful in preparing curious background for a new item of learning. . A soft skill is inculcated.
3	Role Play	Students take the role of actual persons in the field and enact the process	Creates a sense of understanding leading to responsible learning. . A soft skill is inculcated.
4	Modeling	Students prepare models of the existing and futuristic situations, real and imaginary. Includes problem solving, physical models, maps, figures and virtual models	Useful in developing skills integrated with knowledge in practical situations. One of the best ways of problem solving. Use of ICT will enhance the outcomes.
5	Peer review	A group of students reviewing the work of other students and also that of authors	Trains in developing insights for better understanding and judging
6	Games & Puzzles	Students solving subject related problems through available game models of designing their own models	Strengthens problem solving traits and invokes use of intelligence
7	Tutorial	Teacher interacting with small groups of students for reviewing the performance of both teacher and students	A good mechanism for obtaining feedback and midway corrections
8	News paper presentation	Teacher or a student presenting the day's matters related to the subject and on-going chapter resulting a discussion for a while	Relates theory to practice, especially the latest practice, a much needed regular intervention
9	Invited lecture	An expert or a faculty teaching a part of the unit in the classroom or at his/her place	Covers the in-house shortages and the students get the advantage of listening to an expert on that topic
10	Panel discussion	Discussing a topic by a panel of teachers, experts or students.	A variety of angles and solutions emerge for a single problem broadening of the

			minds of students. . A soft skill is inculcated.
11	Bulletin board	Students pin the papers they worked out on curricular topics for sharing with others	Motivates students to express themselves, promotes comprehension, writing abilities and freedom of expression.
12	Open text book study	Students study, discuss or answer a test (specially designed) by openly using a standard text book in a session	Motivates a relationship between students and standard books, a life long benefit. Helps in preparing assignments
13	Student magazine	A student magazine is periodically published with academic articles contributed by students	The art of scientifically expressing is encouraged which has both present and future value. It enhances understanding of a standard book or research paper. . A soft skill is inculcated.
14	Report/Review writing	Students write reports or reviews on case studies, projects, books or material	Promotes critical writing and reporting among students. A soft skill is inculcated.
15	Others		

### **I. Outline Model Pedagogic Strategy Cycle:**

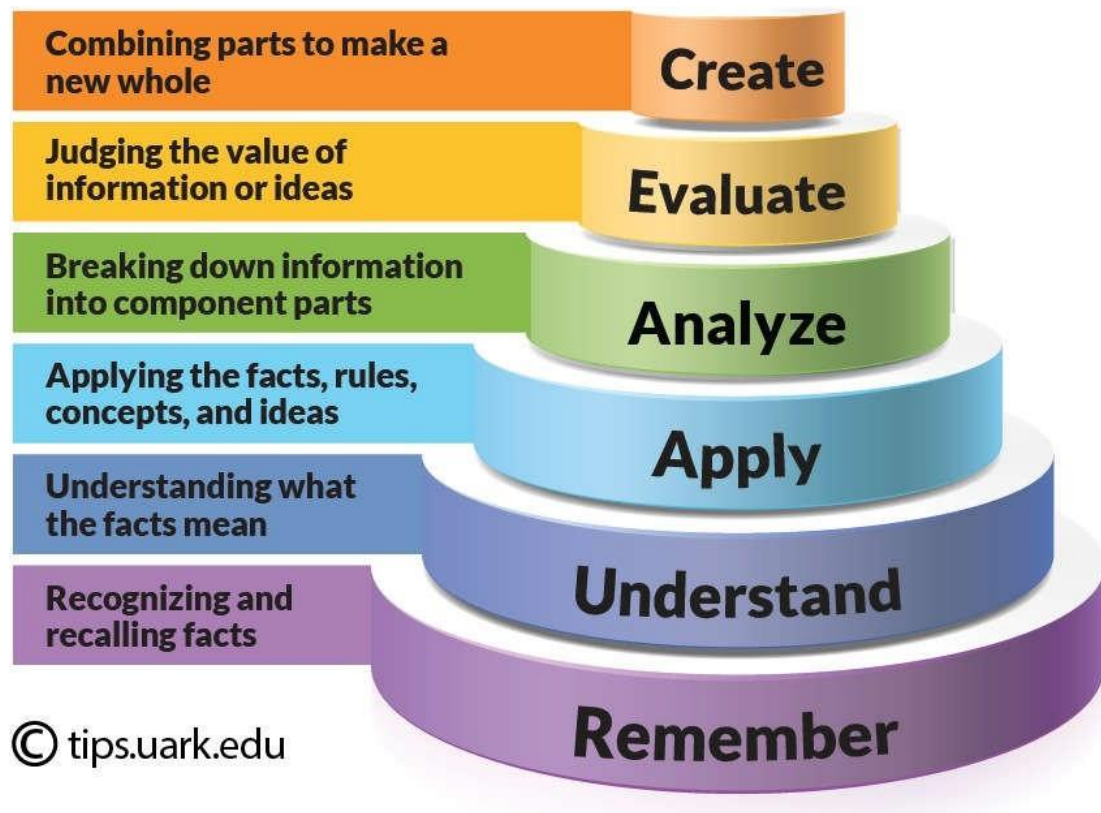
There may be one or more Pedagogic cycles for a single unit depending on the number and nature of the topics in it.

### **II. Other aspects:**

1. The subject pedagogy development committee members shall examine each unit of each paper of their subject under CBCS and prepare pedagogic strategies for facilitating effective teaching and learning of the unit.
2. The pedagogic strategies can be adopted from the tables 1 & 2 above. If necessary, they may add more strategies suitable to their subject to table -2.
3. They shall prepare teaching plans for each unit and give explanation foot notes so that teachers across the state will understand the intentions of the committee members
4. A cycle of Pedagogic Strategies shall be given for each unit with relevant footnotes. A model cycle is given below.
5. A list of suggested suitable topics shall also be given for strategies like case study, assignments, models, project work, class seminar, videos and their open online sources (such as Swayam or NPTEL), websites for online learning etc.
6. It is intended to publish the subject-wise teaching plans and circulate them among colleges. Hence, the teaching plans with pedagogic strategies shall be prepared in the best possible way.

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## BLOOMS REVISED TAXONOMY



A group of cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists published in 2001 a revision of Bloom's Taxonomy with the title *A Taxonomy for Teaching, Learning, and Assessment*. This title draws attention away from the somewhat static notion of "educational objectives" (in Bloom's original title) and points to a more dynamic conception of classification.

The authors of the revised taxonomy underscore this dynamism, using verbs and gerunds to label their categories and subcategories (rather than the nouns of the original taxonomy).



			<b>Critical Thinking</b>		<b>Evaluation</b>
					Appraise
			<b>Synthesis</b>		Argue
			Arrange	Assess	
			<b>Analysis</b>	Assemble	Choose
			Analyze	Categorize	Compare
			<b>Application</b>	Appraise	Conclude
			Apply	Arrange	Contrast
			Calculate	Associate	Convince
			Change	Breakdown	Criticize
			Complete	Categorize	Critique
<b>Knowledge</b>	<b>Comprehension</b>			Create	
Arrange	Compute	Conduct	Combine	Design	Decide
Cite	Convert	Construct	Connect	Develop	Defend
Collect	Discuss	Demonstrate	Debate	Devise	Determine
Count	Distinguish	Discover	Detect	Explain	Evaluate
Define	Estimate	Dramatize	Determine	Formulate	Grade
Delineate	Explain	Employ	Diagram	Generate	Judge
Describe	Express	Illustrate	Differentiate	Group	Justify
Duplicate	Extend	Interpret	Discriminate	Integrate	Measure
Identify	Extrapolate	Interpolate	Distinguish	Invent	Rank
Label	Generalize	Manipulate	Examine	Manage	Rate
List	Give examples	Modify	Experiment	Modify	Recommend
Match	Indicate	Operate	Infer	Order	Revise
Name	Infer	Predict	Inspect	Organize	Score
Order	Locate	Prepare	Inventory	Plan	Select
Outlines	Paraphrase	Practice	Order	Prescribe	Support
Point	Predict	Produce	Outline	Propose	Value
Quote	Restate	Relate	Point out	Rearrange	
Read	Review	Show	Question	Reconstruct	
Recall	Rewrite	Sketch	Relate	Reorganize	
Recite	Summarize	Solve	Select	Setup	
Recognize	Tell	Translate	Separate	Specify	
Record	Translate	Use	Subdivide	Substitute	
Relate			Test	Tell	
Repeat			Utilize	Transform	
Report					
Reproduce					
Select					
Specify					
State					
Tell					

These “action words” describe the cognitive processes by which thinkers encounter and work with knowledge:

- Remember
  - Recognizing
  - Recalling
- Understand
  - Interpreting
  - Exemplifying
  - Classifying
  - Summarizing
  - Inferring
  - Comparing

- Explaining
- Apply
  - Executing
  - Implementing
- Analyze
  - Differentiating
  - Organizing
  - Attributing
- Evaluate
  - Checking
  - Critiquing
- Create
  - Generating
  - Planning
  - Producing

In the revised taxonomy, knowledge is at the basis of these six cognitive processes, but its authors created a separate taxonomy of the types of knowledge used in cognition:

- Factual Knowledge
  - Knowledge of terminology
  - Knowledge of specific details and elements
- Conceptual Knowledge
  - Knowledge of classifications and categories
  - Knowledge of principles and generalizations
  - Knowledge of theories, models, and structures
- Procedural Knowledge
  - Knowledge of subject-specific skills and algorithms
  - Knowledge of subject-specific techniques and methods
  - Knowledge of criteria for determining when to use appropriate procedures
- Meta cognitive Knowledge
  - Strategic Knowledge
  - Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge
  - Self-knowledge

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**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**DEPARTMENT OF BOTANY**

**Programme: B.Sc Botany**

**Objectives of the Programme of B.Sc Botany**

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 Biochemistry, Bioinformatics, Taxonomy, Economic Botany and Ecology

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**DEPARTMENT OF BOTANY**

**COURSE OUTCOMES**

**SEMESTER - 1**

- CO1: The structure in relation to function of cells the fundamental unit of life, are concerned in this course along with molecular present in cells and the flow they make the basic framework of cells and their continuity  
CO2: awareness created on diversity on Algae, Fungi  
CO3: knowledge created on microbial diversity

**SEMESTER – 2**

- CO1: Diversified plant groups in vascular cryptogams  
CO2: Deals with flowering seeded plants with economic importance  
CO3: Analyze the tissue systems and their structural and functional role  
CO4: deals with secondary growth of some important plants

**SEMESTER – 3**

- CO1: fundamental components of taxonomical study  
CO2: Nomenclature of flowering plants and their distribution  
CO3: Complete knowledge about important families like Cucurbitaceae, euphorbiaceae, etc.  
CO4: Total awareness gained from plant embryology

**SEMESTER – 4**

- CO1: knowledge about the metabolism of plant  
CO2: awareness of absorption of water in plants  
CO3: aware with the mechanism of photosynthesis, respiration in plants  
CO4: knowledge developed about phytohormonal regulations and photoperiodism

**SEMESTER - 5**

- CO1: knowledge created about ecological plant species, ecotypes  
CO2: awareness created about geographical distribution of plant species  
CO3: detailed study about ultra-structure of cell is possible  
CO4: plant genome study in structural and functional aspect is possible

**SEMESTER – 6**

- CO1: Study about tissue culture methods and applications are extensively studied with application point of view  
CO2: Study about Mushroom cultivation and applications extensively studied with application point of view

S. No.	Semester	Title of the Course(Paper)	Hours /week	Max. Marks (SEE)	Marks in CIA	Credits
1.	Sem.-I/ Course-1	Fundamentals of Microbes and Non-vascular Plants	04	50	50	02
	Course-1 1Practica 1	Fundamentals of Microbes and Non-vascular Plants	03	Max. Marks-50 Internal assessment at Semester end		02
2.	Sem.-II/ Course-2	Basics of Vascularplants and Phytogeography	04	50	50	02
	Course-2 2Practica 1	Basics of Vascular plants and Phytogeography	03	Max. Marks-50 External assessment at Semester end		02
3.	Sem.-III/ Course-3	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	04	50	50	02
	Course-3 3Practica 1	Anatomy and Embryology of Angiosperms,Plant Ecology and Biodiversity	03	Max. Marks-50 Internal assessment at Semester end		02
4.	Sem.-IV Course-4	Plant Physiology and Metabolism	03	50	50	02
	Course-4 4Practical	Plant Physiology and Metabolism	03	Max. Marks-50 External assessment at Semester end		02
5.	Sem.-IV Course-5	Cell Biology, Genetics and Plant Breeding	04	50	50	02
	Course-5 5Practical	Cell Biology, Genetics and Plant Breeding	03	Max. Marks-50 External assessment at Semester end		02
6.	Sem.-V  Course – 6 &7	PAPER 6 – PLANT TISSUE CULTURE	03	60	40	03
			03	Max.Marks-50 Internal assessment at Semester end		02
		PAPER 7- MUSHROOM CULTIVATION	03	60	40	03
			03	Max. Marks-50 Internal assessment at Semester end		02
<b>INTERNSHIP FOR 6 MONTHS</b>						

Introduced certificate course	Mushroom cultivation	40 Hrs
	Mini nurseries	40 Hrs
Botanical tour	Pandirimamidi research station	Jan/Feb
Hands on training	Grafting techniques in Kakinada agriculture department	
Best practices	Propagation of plants and distribution to local communities	
Waste to best practices	Models preparation using plastic wastes,e-wastes etc., Reuse of plastic bottles for growing plants	

**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. 2022- 23 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	<u>SECTION-A</u> ESSAY QUESTIONS (EQ)	6	10	60	3	10	30
2	<u>SECTION-B</u> SHORT ANSWER QUESTIONS (SAQ)	6	5	30	4	5	20
<b>Total Questions &amp; Total Marks =</b>		<b>12</b>	<b>-</b>	<b>90</b>	<b>7</b>	<b>-</b>	<b>50</b>

$$\text{Percentage of choice given} = \frac{90 - 50}{100} \times 100 = \frac{40}{100} \times 100 = 40$$



**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I B.Sc., -Botany-I/ I Semester End (W.E.F. 2022-23)**

**FUNDAMENTALS OF MICROBES AND NON-VASCULAR PLANTS**

**(COURSE: BO1207)**

Total hours of Teaching 60hrs @ 4 hrs/week

Total Credits:03

**UNIT – I: ORIGIN OF LIFE AND VIRUSES** **12 Hrs.**

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment. Five kingdom classification of R.H. Whittaker
2. Discovery of microorganisms, Pasteur experiments, germ theory of diseases.
3. Shape and symmetry of viruses; structure of TMV and Gemini virus; multiplication of TMV; A brief account of Prions and Viroid's.
4. A general account on symptoms of plant diseases caused by Viruses. Transmission of plant viruses and their control.
5. Significance of viruses in vaccine production, bio-pesticides and as cloning vector, Structure and functions of Scanning Electron Microscope, Transmission Electron Microscope.

**UNIT – II: SPECIAL GROUPS OF BACTERIA AND EUBACTERIA** **12 Hrs.**

1. Brief account of Archaeobacterial, Actinomycetes and Cyanobacteria.
2. Cell structure and nutrition of Eubacteria.
3. Reproduction- Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation, Transduction).
4. Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine).
5. A general account on symptoms of plant diseases caused by Bacteria; Citrus canker,

**UNIT – III: FUNGI & LICHENS** **12 Hrs.**

1. General characteristics of fungi and Ainsworth classification (upto classes).
2. Structure, reproduction and life history of (a) Rhizopus (Zygomycota) and (b) Puccinia (Basidiomycota).
3. Economic uses of fungi in food industry, pharmacy and agriculture.
4. A general account on symptoms of plant diseases caused by Fungi; Blast of Rice,
5. Lichens- structure and reproduction; ecological and economic importance.

**UNIT – IV: ALGAE** **12 Hrs.**

1. General characteristics of Algae (pigments, flagella and reserve food material); Fritsch classification (upto classes).
2. Thallus organization and life cycles in Algae.
3. Occurrence, structure, reproduction and life cycle of (a) Chara (Chlorophyceae) and
4. (b) Polysiphonia (Rhodophyceae).
5. Economic importance of Algae.

**UNIT – V: BRYOPHYTES** **12 Hrs.**

1. General characteristics of Bryophytes; classification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) Marchantia and (b) Funaria (Bryopsida).
3. General account on evolution of sporophytes in Bryophyta.

**Text books :**

- Botany – I (Vrukshasastram-I): Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi
- Hait, G., K. Bhattacharya & A.K. Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
- Bhattacharjee, R.N., (2017) Introduction to Microbiology and Microbial Diversity, Kalyani Publishers, New Delhi.

**Books for Reference:**

- Dubey, R.C. & D.K. Maheswari (2013) A Text Book of Microbiology, S. Chand & Company Ltd., New Delhi
- Pelczar Jr., M.J., E.C.N. Chan & N.R. Krieg (2001) Microbiology, Tata McGraw-Hill Co, New Delhi
- Prescott, L. Harley, J. and Klein, D. (2005) Microbiology, 6th edition, Tata McGraw – Hill Co. New Delhi.
- Alexopoulos, C.J., C.W. Mims & M. Blackwell (2007) Introductory Mycology, Wiley & Sons, Inc., New York
- Mehrotra, R.S. & K. R. Aneja (1990) An Introduction to Mycology. New Age International Publishers, New Delhi
- Kevin Kavanagh (2005) Fungi; Biology and Applications John Wiley & Sons, Ltd., West Sussex, England
- John Webster & R. W. S. Weber (2007) Introduction to Fungi, Cambridge University Press, New York
- Fritsch, F.E. (1945) The Structure & Reproduction of Algae (Vol. I & Vol. II) Cambridge University Press Cambridge, U.K.
- Bold, H.C. & M. J. Wynne (1984) Introduction to the Algae, Prentice-Hall Inc., New Jersey
- Robert Edward Lee (2008) Phycology. Cambridge University Press, New York
- Van Den Hoek, C., D.G. Mann & H.M. Jahns (1996) Algae : An Introduction to Phycology. Cambridge University Press, New York
- Shaw, A.J. & B. Goffinet (2000) Bryophyte Biology. Cambridge University Press, New York.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I B.Sc., BOTANY PRACTICAL PAPER – I PRACTICAL SYLLABUS  
FUNDAMENTALS OF MICROBES AND NON-VASCULAR PLANTS**

Total hours of laboratory Exercises 30 hrs @ 2 per week

Total credits:02

**PRACTICAL SYLLABUS:**

1. Knowledge of Microbiology laboratory practices and safety rules.
2. Knowledge of different equipment for Microbiology laboratory (Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, Laminar air flow chamber and Incubator) and their working principles. (In case of the non-availability of the laboratory equipment the students can be taken to the local college/clinical lab. with required infrastructural facilities or they can enter a linkage with the college/lab for future developments and it will fetch credits during the accreditation by NAAC).
3. Demonstration of Gram's staining technique for Bacteria.
4. Study of Viruses (Corona, Gemini and TMV) using electron micrographs/ models.
5. Study of Archaeobacteria and Actinomycetes using permanent slides/ electron micrographs/diagrams.
6. Study of Anabaena and Oscillatoria using permanent/temporary slides.
7. Study of different bacteria (Cocci, Bacillus, Vibrio and Spirillum) using permanent or temporary slides/ electron micrographs/ diagrams.
8. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts:
  - a. Algae: Volvox, Chara, Ectocarpus and Polysiphonia
  - b. Fungi: Rhizopus and Puccinia
  - c. Lichens: Crustose, foliose and fruticose
  - d. Bryophyta: Marchantia and Funaria
9. Study of specimens of Tobacco mosaic virus, Citrus canker and Blast of Rice.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc., Botany Practical Examinations at the End of Semester-I**  
**FUNDAMENTALS OF MICROBES AND NON-VASCULAR PLANTS**  
**Botany Practical Model Paper-I (w.e.f 2022-23)**

**Time: 2 hours**

**Max. Marks: 50**

- 
1. Analyze T.S. of material 'A' (Fungi), make a temporary mount and make comments about identification. 10 M
  2. Differentiate any 2 algae from the mixture (material 'B') given with specific comments about identification. 10 M
  3. Analyze the T.S. of material 'C' (Bryophyta), make a temporary mount and make comments about identification. 10 M
  4. Identify the following with specific reasons. 4 x 3 = 12 M  
D. A laboratory equipment of Microbiology  
E. Virus  
F. Other microbial specialized Bacteria  
G. Lichen
  5. Record + Viva-voce 5 + 3 = 08 M

**Suggested co-curricular activities for Botany Core Course-1 in Semester-I:**

**A. Measurable:**

**a. Student seminars:**

1. Baltimore classification of Viruses.
2. Lytic and lysogenic cycle of T- even Bacteriophages.
3. Viral diseases of humans and animals.
4. Retroviruses
5. Bacterial diseases of humans and animals.
6. Significance of Bacteria in Biotechnology and Genetic engineering.
7. Fungi responsible for major famines in the world.
8. Poisonous mushrooms (Toad stools).
9. Algae as Single Cell Proteins (SCPs)
10. Parasitic algae
11. Origin of Bryophytes through: Algae vs Pteridophytes
12. Fossil Bryophytes
13. Evolution of gametophytes in Bryophyta
14. Ecological and economic importance of Bryophytes.

**b. Student Study Projects:**

1. Isolation and identification of microbes from soil, water and air.
2. Collection and identification of algae from fresh /estuarine /marine water.
3. Collection and identification of fruiting bodies of Basidiomycetes and Ascomycetes.
4. Collection and identification of Lichens from their native localities.
5. Collection of diseased plants/parts and identification of symptoms.
  
6. Collection and identification of Bryophytes from their native localities.

- c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General:**

1. Visit to Agriculture and/or Horticulture University/College/Research station to learn about microbial diseases of plants.
2. Visit to industries working on microbial, fungal and algal products.
3. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I Year B.Sc., Degree Examinations at I Semester End  
Botany Paper I: FUNDAMENTALS OF MICROBES AND NON-VASCULAR  
PLANTS**

**(Course: BO1207 Model Paper w.e.f. 2022-23)**

**Time: 2Hrs.**

**Max. Marks: 50**

**SECTION – A**

**3 × 10 = 30 M**

Answer any **THREE** of the following by choosing atleast one question from each Part.

**PART – I**

1. a. Transmission of plant diseases caused by viruses and their control  
**OR**  
b. Illustrate five kingdom classification
2. a. Describe the sexual reproduction in bacteria  
**OR**  
b. Explain about economic importance of bacteria
3. a. Explain about Lichen structure and reproduction  
**OR**  
b. Describe the life cycle of Puccinia on Barberry plant

**PART - II**

4. a. Explain about thallus organization in Algae  
**OR**  
b. Describe the sexual reproduction in Polysiphonia
5. a. Describe the sexual reproduction in Marchantia  
**OR**  
b. General account on evolution of sporophytes in Bryophytes
6. a. Elucidate the sexual reproduction in Rhizopus.  
**OR**  
b. Analyze the asexual reproduction in lichens

**SECTION – B**

**4 × 5 = 20 M**

Answer any **FOUR** of the following Questions

1. Germ theory of diseases
2. Prions
3. Actinomycetes
4. Ecological importance of Lichens
5. Economic importance in fungi
6. General characteristics of bacteria

### **BLUE PRINT FOR QUESTION SETTER**

<b>UNIT NO / TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>Marks allotted to the Module</b>
<b>UNIT – I: ORIGIN OF LIFE AND VIRUSES</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT – II: SPECIAL GROUPS OF BACTERIA AND EUBACTERIA</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT – 3: FUNGI &amp; LICHENS</b>	<b>4</b>	<b>2</b>	<b>50</b>
<b>UNIT – 4: ALGAE</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT – 5: BRYOPHYTES</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>Total Marks Allotted To All Questions Including Choice</b>			<b>150</b>

Note: Question paper setters are requested to adhere strictly to the above blue print while preparing the said paper

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc-Botany-I/ I Semester End (W.E.F. 2022-23)**  
**FUNDAMENTALS OF MICROBES AND NON-VASCULAR PLANTS**

**I B.Sc-Botany-I/ I Semester Question Bank**

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**UNIT – I: ORIGIN OF LIFE AND VIRUSES**

Essay Questions

1. Illustrate Five kingdom classification
2. Explain about Transmission of plant viruses and their control
3. Miller & Urey experiment
4. General account on significance of Viruses in vaccines and biopesticides production

Short Answer Questions

1. Viroid
2. Prions
3. Germ theory of diseases
4. Pasteur's experiment

**UNIT – II: SPECIAL GROUPS OF BACTERIA AND EUBACTERIA**

Essay Questions

1. Explain recombination in Bacteria
2. Describe nutritional types & economic importance of Bacteria
3. Describe the Cell structure of Eubacteria

Short Answer Questions

1. Archaeobacteria
2. Cyanobacteria
3. Citrus canker

**UNIT – III: FUNGI & LICHENS**

Essay Questions

1. General note on Lichen reproduction
2. Describe the life cycle of Puccinia on wheat plant
3. Describe the sexual reproduction in Rhizopus
4. General characters of Fungi

Short Answer Questions

1. Spermogonium
2. Blast of rice
3. Economic importance of Fungi
4. Economic importance of Lichens

**UNIT – IV: ALGAE**

Essay Questions

1. Illustrate thallus organization in Algae
2. Describe the sexual reproduction in Polysiphonia
3. Explain the classification of Algae
4. Describe the reproduction in Chara.



Short Answer Questions

1. Pigments in Algae
2. Economic importance of Algae
3. Cystocarp

**UNIT – V: BRYOPHYTES**

Essay Questions

1. Describe the sexual reproduction in Marchantia
2. Explain about evolution of sporophytes in Bryophytes
3. Describe the structure of Funaria capsule

Short Answer Questions

1. Protonema
2. Gemma cup
3. Marchantia T.S.of Thallus

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc., -Botany-II/ II Semester End (W.E.F. 2022-23)**

**BASICS OF VASCULAR PLANTS AND PHYTOGEOGRAPHY (COURSE: BO2207)**

Total hours of Teaching 60hrs @ 4 hrs/week

Total Credits:02

**UNIT – I: PTERIDOPHYTES** **12 Hrs.**

1. General characteristics of Pteridophyta; classification of Smith (1955) up to divisions.
2. Occurrence, morphology, anatomy, reproduction and life history of (a) Lycopodium (Lycopsida) and (b) Marsilea (Filicopsida).
3. Stelar evolution in Pteridophytes;
4. Heterospory and seed habit.

**UNIT – II: GYMNOSPERMS** **14 Hrs.**

1. General characteristics of Gymnosperms; Sporne classification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) Pinus (Coniferopsida) and (b) Gnetum (Gnetopsida).
3. Outlines of geological time scale.
4. A brief account on Cycadeoidea.

**UNIT – III: BASIC ASPECTS OF TAXONOMY** **13 Hrs.**

1. Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family. Taxonomic Keys.
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. Systematic description and economic importance of the following families:  
(a) Annonaceae (b) Curcubitaceae

**UNIT – IV: SYSTEMATIC TAXONOMY** **13 Hrs.**

1. Systematic description and economic importance of the following families:  
(a) Asteraceae (b) Asclepiadaceae (c) Apocynaceae (d) Euphorbiaceae  
(e) Arecaceae and (f) Poaceae g) Orchidaceae
2. Outlines of Angiosperm Phylogeny Group (APG IV).

**UNIT – V: PHYTOGEOGRAPHY** **08 Hrs.**

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

### TEXT BOOKS:

- Botany – I (Vrukshasastram-I): Telugu Akademi, Hyderabad
- Botany – II (Vrukshasastram-II): Telugu Akademi, Hyderabad
- Acharya, B.C., (2019) Archchegoniaties, Kalyani Publishers, New Delhi
- Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
- Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi
- Pandey, B.P. (2013) College Botany, Volume-II, S. Chand Publishing, New Delhi

### BOOKS FOR REFERENCE:

- Smith, G.M. (1971) Cryptogamic Botany Vol. II., Tata McGraw Hill, New Delhi
- Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi
- Kramer, K.U. & P. S. Green (1990) The Families and Genera of Vascular Plants, Volume –I: Pteridophytes and Gymnosperms (Ed. K. Kubitzki) Springer-Verlag, New York
- Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi
- Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
- Govil, C.M. (2007) Gymnosperms: Extinct and Extant. KRISHNA Prakashan Media (P) Ltd. Meerut & Delhi
- Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
- Arnold, C.A., (1947) An introduction to Paleobotany McGraw – Hill Book Company, INC, New York
- Stewart, W.N., and G.W. Rothwell (2005) Paleobotany and the evolution of plants Cambridge University Press, New York
- Lawrence, George H.M. (1951) Taxonomy of Vascular Plants. The McMillan Co., New York
- Heywood, V. H. and D. M. Moore (1984) Current Concepts in Plant Taxonomy. Academic Press, London.
- Jeffrey, C. (1982) An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
- Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt. Ltd., New Delhi
- Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
- Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
- Cain, S.A. (1944) Foundations of Plant Geography Harper & Brothers, N.Y.
- Good, R. (1997) The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi
- Mani, M.S (1974) Ecology & Biogeography of India Dr. W. Junk Publishers, The Hague

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I B.Sc., BOTANY PRACTICAL PAPER – II PRACTICAL SYLLABUS**

**BASICS OF VASCULAR PLANTS AND PHYTOGEOGRAPHY**

Total hours of laboratory Exercises 30 hrs @ 2 per week

Total credits:02

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**PRACTICAL SYLLABUS:**

1. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts:
  - a. Pteridophyta: Lycopodium and Marselia
  - b. Gymnosperms: Pinus and Gnetum
2. Study of fossil specimens of Cycadeoidea and Pentoxylon (photographs /diagrams can be shown if specimens are not available).
3. Demonstration of herbarium techniques.
4. Systematic / taxonomic study of locally available plants belonging to the families prescribed in theory syllabus. (Submission of 30 number of Herbarium sheets of wild plants with the standard system is mandatory).
5. Mapping of phytogeographical regions of the globe and India.
6. Mapping of Phytogeographical regions of Andhra Pradesh
7. Permanent slide preparation.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc., Botany Practical Examinations at the End of Semester-II**  
**BASICS OF VASCULAR PLANTS AND PHYTOGEOGRAPHY**  
**Botany Practical Model Paper-I (w.e.f 2022-23)**

**Time: 2 hours**

**Max. Marks: 50**

1. Analyze T.S. of the material 'A' (Pteridophyta), make a temporary slide and justify the identification with apt points. 10 M
2. Analyze T.S. of the material 'B' (Gymnosperms), make a temporary slide and justify the identification with apt points. 10M
3. Describe the vegetative and floral characters of the material 'C' (Taxonomy of Angiosperms) and derive its systematic position. 10 M
4. Identify the specimen 'D' (Fossil Gymnosperm) and give specific reasons. 05 M
5. Locate the specified phytogeographical regions (2x2M) in the world / India (E) map supplied to you. 04 M
6. Record + Herbarium & Field note book + Viva-voce 5 + 4 + 3 = 12 M

**Suggested co-curricular activities for Botany Core Course-2 in Semester-II:**

**A. Measurable:**

**a. Student seminars:**

1. Fossil Pteridophytes.
2. Aquatic ferns and tree ferns
3. Ecological and economic importance of Pteridophytes
4. Evolution of male and female gametophytes in Gymnosperms.
5. Endemic and endangered Gymnosperms.
6. Ecological and economic importance of Gymnosperms.
7. Floras and their importance: Flora of British India and Flora of Madras Presidency.
8. Botanical gardens and their importance: National Botanic garden and Royal Botanic garden.
9. Artificial, Natural and Phylogenetic classification systems.
10. Molecular markers used in APG system of classification.
11. Vessel less angiosperms.
12. Insectivorous plants.
13. Parasitic angiosperms.
14. Continental drift theory and species isolation.

**b. Student Study Projects:**

1. Collection and identification of Pteridophytes from their native locality/ making an album by collecting photographs of Pteridophytes.
2. Collection and identification of Gymnosperms from their native locality/ making an album by collecting photographs of Gymnosperms.
3. Collection of information on famous herbaria in the world and preparation of a report.
4. Collection of information on famous botanic gardens in the world and preparation of a report.
5. Collection of data on vegetables (leafy and fruity) plants in the market and preparation of a report on their taxonomy.
6. Collection and identification of fresh and dry fruits plants in the market and preparation of a report on their taxonomy.

7. Collection of data on plants of ethnic and ethnobotanical importance from Their native locality.

8. Preparation of a local flora by enlisting the plants of their native place.

a. **Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General:**

1. Visit to Botanic garden in a Research institute/University to see the live plants.
2. Virtual tour in websites for digital herbaria and botanic gardens.
3. Acquaint with standard floras like – Flora of Madras Presidency, Flora of their respective district in Andhra Pradesh.
4. Looking into vegetation of different phytogeographical regions using web resources.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I Year B.Sc., Degree Examinations at II Semester End**  
**Botany Paper II: BASICS OF VASCULAR PLANTS AND PHYTOGEOGRAPHY OF**  
**PLANTS**

(Course: BO2207 Model Paper w.e.f. 2022-23)

**Time: 2Hrs.**

**Max. Marks: 50**

**SECTION – A**

**3 × 10 = 30 M**

Answer any **THREE** of the following by choosing atleast one question from each Part.

**PART - I**

1. a) Give a brief account on stellar evolution in Pteridophytes  
OR  
b) Describe the reproduction in Marselia
2. a) Describe the reproduction in Pinus  
OR  
b) General characters of Gymnosperms
3. a) General account on Bentham & Hooker classification  
OR  
b) Give a note on systematic description of Cucurbitaceae

**PART - II**

4. a) Give a detailed account of Euphorbiaceae  
OR  
b) Give a systematic description of Asclepiadaceae
5. a) Illustrate phytogeography regions in India  
OR  
b) Give an account on Endemism
6. a) Give a detailed note on Rules of ICBN  
OR  
b) write about herbarium preparation & its significance.

**SECTION – B**

**4 × 5 = 20 M**

Answer any **FOUR** of the following Questions

1. Marsilea Petiole
2. Seed habit
3. General characters of Gymnosperms
4. Economic importance of Poaceae
5. Floral Characters of Cucurbitaceae
6. Gnetum male cone

### **BLUE PRINT FOR QUESTION SETTER**

<b>UNIT NO / TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>Marks allotted to the Module</b>
<b>UNIT – I: PTERIDOPHYTES</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT – II: GYMNOSPERMS</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT – III: BASIC ASPECTS OF TAXONOMY</b>	<b>4</b>	<b>2</b>	<b>50</b>
<b>UNIT – IV: SYSTEMATIC TAXONOMY</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT – V: PHYTOGEOGRAPHY</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>Total marks allotted to all questions including choice</b>			<b>150</b>

Note: Question paper setters are requested to adhere strictly to the above blue print while preparing the said paper



**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc-Botany-II/ II Semester End (W.E.F. 2022-23)**  
**Botany Paper II: BASICS OF VASCULAR PLANTS AND PHYTOGEOGRAPHY**  
**I B.Sc-Botany-II/ II Semester Question Bank**

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**UNIT – I: PTERIDOPHYTES**

Essay Questions

1. Explain stelar evolution in Pteridophytes.
2. Explain Marselia reproduction .
3. Explain Lycopodium sexual reproduction

Short Answer Questions

1. Lycopodium stem anatomy.
2. Marsilea Rhizome.
3. Seed habit
4. Marsilea petiole
5. Heterospory

**UNIT – II: GYMNOSPERMS**

Essay Questions

1. General characters of Gymnosperms
2. Describe the reproduction in Pinus
3. Describe the reproduction in Gnetum

Short Answer Questions

1. Pinus male cone.
2. Pinus female cone
3. L.S of Pinus Ovule.
4. Gnetum male cone
5. Gnetum ovule.

**UNIT – III: BASIC ASPECTS OF TAXONOMY**

Essay Questions

1. Explain the Bentham & Hooker Classification
2. Explain systematic description of Cucurbitaceae
3. Explain Herbarium Preparation & its Significance
4. Give a detailed note on rules of ICBN

Short Answer Questions

1. Floral characters of Annonaceae
2. Outlines of APG-IV
3. Typification
4. Binomial System

**UNIT – IV: SYSTEMATIC TAXONOMY**

Essay Questions

1. systematic description of Apocynaceae
2. systematic description of Euphorbiaceae
3. systematic description of Asclepiadaceae

Short Answer Questions

1. Economic importance of Asteraceae.
2. Floral characters of Poaceae
3. Economic importance of Aracaceae
4. Subfamilies in Asclepiadaceae

**UNIT – V: PHYTOGEOGRAPHY**

Essay Questions

1. Explain about Phytogeographic regions in World
2. Explain about Phytogeographic regions in India
3. Explain about Endemism

Short Answer Questions

1. Vegetation types in AP
2. Phytogeography distribution

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., -Botany-III / III Semester End (W.E.F. 2022-23)**

**Anatomy, Embryology of Angiosperms, Plant Ecology and Biodiversity**

Total hours of Teaching 60hrs @ 4 hrs/week

Total Credits:02

**Learning outcomes:**

- On successful completion of this course, the students will be able to;
- Understand on the organization of tissues and tissue systems in plants.
- Illustrate and interpret various aspects of embryology.
- Discuss the basic concepts of plant ecology, and evaluate the effects of environmental and biotic factors on plant communities.
- Appraise various qualitative and quantitative parameters to study the population and community ecology.
- Correlate the importance of biodiversity and consequences due to its loss.
- Enlist the endemic/endangered flora and fauna from two biodiversity hot spots in India and assess strategies for their conservation.

**Unit – 1: Anatomy of Angiosperms 12 Hrs.**

1. Organization of apical meristems: Tunica-carpus theory and Histogen theory.
2. Tissue systems–Epidermal, ground and vascular,Special tissue.
3. Anomalous secondary growth in *Boerhaavia*, *Dracaena*
4. Study of timbers of economic importance - Teak, Red sanders and Rosewood.

**Unit – 2: Embryology of Angiosperms 12 Hrs.**

1. Structure of anther, anther wall, types of tapetum. Microsporogenesis and development of male gametophyte.
2. Structure of ovule, Megasporogenesis; types of embryo sacs- monosporic, bisporic and tetrasporic .
3. Outlines of pollination, polyembryony and fertilization.
4. Endosperm - Types and biological importance - Free nuclear, cellular, helobial and ruminant.
5. Development of Dicot (*Capsella bursa-pastoris*) Embryo

**Unit – 3: Basics of Ecology 12 Hrs.**

1. Ecology: definition, branches and significance of ecology.
2. Ecosystem: Concept and components, energy flow, food chain, food web, ecological pyramids.
3. Ecotypes, Ecotone and Ecads.
4. Plants and environment: Climatic (light and temperature), edaphic and biotic factors.
5. Ecological succession: Hydro sere and Xerosere.

**Unit – 4: Population, Community and Production Ecology 12 Hrs.**

1. Population ecology: Natality, Mortality, growth curves, ecotypes, ecads
2. Community ecology: Frequency, density, cover, life forms, biological spectrum
3. Concepts of productivity: GPP, NPP and Community Respiration

4. Secondary production, P/R ratio and Ecosystems.
5. Carbon foot printing

**Unit – 5: Basics of Biodiversity 12 Hrs.**

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. Biodiversity in 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.
6. Role of Biodiversity board to protect Biodiversity of A.P

**Text books :**

- Botany – III (Vrukshasastram-I): Telugu Academy, Hyderabad Botany – IV (Vrukshasastram-II): Telugu Academy, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-II*, S. Chand Publishing, New Delhi Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) *A Text Book of Botany, Volume- II*, New Central Book Agency Pvt. Ltd., Kolkata

**Books for Reference:**

- Esau, K. (1971) *Anatomy of Seed Plants*. John Wiley and Son, USA.
- Fahh, A. (1990) *Plant Anatomy*, Pergamon Press, Oxford.
- Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) *Plant Anatomy: An Applied Approach*, Wiley, USA.
- Paula Rudall (1987) *Anatomy of Flowering Plants: An Introduction to Structure and Development*. Cambridge University Press, London
- Bhojwani, S. S. and S. P. Bhatnagar (2000) *The Embryology of Angiosperms (4th Ed.)*, Vikas Publishing House, Delhi.
- Pandey, A. K. (2000) *Introduction to Embryology of Angiosperms*. CBS Publishers & Distributors Pvt. Ltd., New Delhi
- Maheswari, P. (1971) *An Introduction to Embryology of Angiosperms*. McGraw Hill Book Co., London.
- Johri, B.M. (2011) *Embryology of Angiosperms*. Springer-Verlag, Berlin
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Bhattacharya, K., A. K. Ghosh, & G. Hait (2011) *A Text Book of Botany, Volume- IV*, New Central Book Agency Pvt. Ltd., Kolkata
- Kormondy, Edward J. (1996) *Concepts of Ecology*, Prentice-Hall of India Private Limited, New Delhi
- Begon, M., J.L. Harper & C.R. Townsend (2003) *Ecology*, Blackwell Science Ltd., U.S.A.
- Eugene P. Odum (1996) *Fundamentals of Ecology*, Natraj Publishers, Dehradun
- Sharma, P.D. (2012) *Ecology and Environment*. Rastogi Publications, Meerut, India.
- N.S. Subrahmanyam & A.V.S.S. Sambamurty (2008) *Ecology Narosa Publishing House, New Delhi*
- K. Agrawal & P.P. Deo (2010) *Plant Ecology*, Agrobios (India), Jodhpur
- Kumar, H.D. (1992) *Modern Concepts of Ecology (7th Edn.)* Vikas Publishing Co., New Delhi.
- Newman, E.I. (2000): *Applied Ecology* Blackwell Scientific Publisher, U.K.
- Chapman, J.L. & M.J. Reiss (1992): *Ecology - Principles & Applications*. Cambridge University Press, U.K.
- Kumar H.D. (2000) *Biodiversity & Sustainable Conservation* Oxford & IBH Publishing Co Ltd. New Delhi.
- U. Kumar (2007) *Biodiversity: Principles & Conservation*, Agrobios (India), Jodhpur

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., Practical syllabus of Botany Core Course – 3 /Semester – III**  
**Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

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**Practical Syllabus**

1. Tissue organization in root and shoot apices using permanent slides.
2. Anomalous secondary growth in stems of *Boerhavia* and *Dracaena*.
3. Study of anther and ovule using permanent slides/photographs.
4. Study of pollen germination and pollen viability.
5. Dissection and observation of Embryo sac haustoria in *Santalum* or *Argemone*.
6. Structure of endosperm (nuclear and cellular) using permanent slides / Photographs.
7. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
8. Developmental stages of dicot and monocot embryos using permanent slides / photographs.
9. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, rain gauge, and lux meter. (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).
10. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (02 each).
11. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance.
12. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.
13. Find out the alpha-diversity of plants in the area
14. Mapping of biodiversity hotspots of the world and India.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., Botany Practical Examinations at the End of Semester-III**  
**Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity**  
**Botany Practical Model Paper-III (w.e.f 2022-23)**

**Time: 2 hours**

**Max. Marks: 50**

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1. Analyze the T.S. of the material 'A' (Anatomy),  
prepare a temporary slide and justify the identification with specific comments. 1 X 10 = 10 M
  2. Illustrate the procedure for the experiment 'B' (Embryology)  
and demonstrate the same 1 X 10 = 10 M
  3. Analyze the T.S. of the material 'C',  
prepare a temporary slide and justify the identification with specific comments. 1 X 10 = 10 M
  4. Identify the following with specific comments. 4 x 3 = 12 M
- D. Anatomy/Embryology  
E. Ecology instrument  
F. Mapping of Biodiversity hot spot  
G. Endemic/endangered plant/animal
5. Record + Viva-voce 5 + 3 = 8 M
- 
- 50 M

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc-Botany-III/ III Semester End (W.E.F. 2022-23)**  
**ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS, PLANT ECOLOGY AND**  
**BIODIVERSITY**

**II B.Sc-Botany-III Semester Question Bank**

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**UNIT – I: PLANT ANATOMY**

Essay Questions.

- 1 Essay on Shoot Apical Meristem?
- 2 Essay on Xylem
- 3 Explain the anomalous secondary growth in stem of Boerhaavia ?
- 4 Explain the anomalous secondary growth in stem of Dracaena ?

Short Answer Questions

- 1 Histogen Theory
- 2 Tunica Carpus Theory
- 3 Teak wood
- 4 Red Sanders
- 5 Rose Wood
- 6 Latisiferous Tissue

**UNIT – II: EMBRYOLOGY OF ANGIOSPERMS**

Essay Questions.

1. Tetrasporic embryo sac and their development
2. Give an account of Development of male gametophyte in Angiosperms
- 3 Give an account of types of endosperm

Short Answer Questions

1. Polyembryony
2. Types of tapetum
3. Dicot Embryo development
4. Pnemoc Phenomenon
5. Types of Ovules
6. Triple fusion and double fertilization

**UNIT –III: Basics of Ecology**

Essay Questions

1. Illustrate Ecosystem? Describe the different components of an Ecosystem.
2. Define Ecological succession.
3. Describe the role of Light as an ecological factors.



### Short Answer Questions

- 1 Biotic factors
- 2 Food chain
- 3 Food web
- 4 Ecads and Ecotypes
- 5 Ecological pyramids

### **UNIT –IV: Population &Community Ecology**

#### Essay Questions

1. Explain about Community Ecology?
2. Explain about Population Ecology ?
3. Explain Production Ecology?

#### Short Questions

1. Competition
2. Frequency
3. Growth curves
4. Natality and mortality
5. Life forms
6. Carbon footprinting

### **UNIT- V: Basics of Biodiversity**

#### Essay Questions

1. Explain the levels of biodiversity
2. Explain the Biodiversity hotspots in India
3. Explain the conservation principles of biodiversity?

#### Short Questions

1. Earth summit
2. Threat to biodiversity
3. Endemic species of india
4. Role of IUCN in conservation of Biodiversity
5. Red data book

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II Year B.Sc., Degree Examinations at III Semester End**  
**Botany Paper III: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS, PLANT**  
**ECOLOGY AND BIODIVERSITY**  
**(Course: BO4207 Model Paper w.e.f. 2022-23)**

**Time: 2 Hrs.**

**Max. Marks: 50**

**SECTION – A**

**3 × 10 =30 M**

Answer any **THREE** of the following by choosing atleast one question from each Part., draw neat and labeled diagrams wherever necessary

**PART – I**

1. A) Give an essay on shoot Meristems?  
Or  
B) Illustrate anomalous secondary growth in stem Boerhaavia?
2. A) Describe the tetrasporic Embryosac and their development.  
Or  
B) Give an account of development of male gametophyte in Angiosperms?
3. A) Give a note on Ecosystem? Describe the different components of an Ecosystem?  
Or  
B) Describe the role of Light as an ecological Factor ?

**PART – II**

- 4 A) General account on Community Ecology?  
OR  
B) General account on Population Ecology
- 5 A) Illustrate the levels of Biodiversity  
Or  
B) Give a detailed note on Biodiversity Hotspots in India
- 6 A) write an essay on Xylem tissue  
OR  
B) Explain the types of endosperms.

**SECTION – B**

**4 × 5=20 M**

Answer Any **FOUR** Of The Following Questions, Draw Neat And Labeled Diagrams Wherever Necessary

1. Histogen theory
2. Types of tapetum
3. Biotic factors
4. Growth curves
5. Threat to Biodiversity
6. Red Data Book

**BLUE PRINT FOR QUESTION SETTER**

<b>UNIT NO/ TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>MARKS ALLOTTED TO THE MODULE</b>
<b>UNIT-I: ANATOMY OF ANGIOSPERMS</b>	<b>3</b>	<b>2</b>	<b>40</b>
<b>UNIT-II :EMBRYOLOGY OF ANGIOSPERMS</b>	<b>3</b>	<b>1</b>	<b>35</b>
<b>UNIT-III: BASICS OF ECOLOGY</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-IV : POPULATION, COMMUNITY, AND PRODUCTION</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-V: BASICS OF BIODIVERSITY</b>	<b>2</b>	<b>1</b>	<b>25</b>
Total marks allotted to all questions including choice			<b>150</b>

**Note:** Question paper setters are requested to adhere strictly to the above blue print while preparing the said paper

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., -Botany-IV/ IV Semester End (W.E.F. 2022-23) PLANT**  
**PHYSIOLOGY AND METABOLISM (COURSE: BO4207)**

Total hours of Teaching 60hrs @ 4 hrs/week

Total Credits:03

**UNIT – 1: PLANT-WATER RELATIONS ( 10 Hrs)**

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

**UNIT – II: Mineral Nutrition, Enzymes And Respiration (14 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.

**UNIT – III: Photosynthesis and Photorespiration (12 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 (C<sub>3</sub>,C<sub>4</sub> and CAM);
4. Photorespiration - C<sub>2</sub> pathway

**UNIT – IV: Nitrogen and lipid metabolism (12 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,  $\beta$ -oxidation of fatty acids, Glyoxylate cycle.

**Unit – V: Plant growth - development and stress physiology (12 Hrs)**

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.

### **Text books:**

- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi –
- Ghosh, A. K., K. Bhattacharya & G. Hait (2011)
- A Text Book of Botany, Volume III, New Central Book Agency Pvt. Ltd.
- , Kolkata Books for Reference: – Aravind Kumar & S.S. Purohit (1998)
- Plant Physiology – Fundamentals and Applications, AgroBotanica,
- Bikaner – Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd.,
- Publishers, New Delhi – Hans Mohr & P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd., New Delhi – Hans-Walter Heldt (2005) Plant Biochemistry, Academic Press, U.S.A. – Hopkins, W.G. & N.P.A. Huner (2014) Introduction to Plant Physiology,
- Wiley India Pvt. Ltd., New Delhi – Noggle Ray & J. Fritz (2013) Introductory Plant Physiology,
- Prentice Hall (India), New Delhi – Pandey, S.M. & B.K. Sinha (2006) Plant Physiology, Vikas Publishing House, New Delhi – Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology,
- Thomsen & Wadsworth, Australia & U.S.A – Sinha, R.K. (2014) Modern Plant Physiology,
- Narosa Publishing House, New Delhi – Taiz, L. & E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi – Verma,
- V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**II B.Sc., BOTANY PRACTICAL PAPER – IV PRACTICAL SYLLABUS**

**PLANT PHYSIOLOGY AND METABOLISM**

Total hours of laboratory Exercises 30 hrs @ 2 per week

Total credits:02

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**Suggested Laboratory Exercises:**

1. Osmosis – by potato osmoscope experiment
2. Determination of osmotic potential of plant cell sap by plasmolytic method using leaves of *Rhoeo* / *Tradescantia*.
3. Structure of stomata (dicot & monocot)
4. Determination of rate of transpiration using cobalt chloride method
5. Demonstration of ascent of sap/Transpiration pull.
6. Effect of Temperature on membrane permeability by colorimetric method.
7. Study of mineral deficiency symptoms using plant material/photographs.
8. Separation of chloroplast pigments using paper chromatography technique.
9. Rate of photosynthesis under varying  $\text{CO}_2$  concentrations.
10. Effect of light intensity on oxygen evolution in photosynthesis using Wilmott' bubbler
11. Respiration – Aerobic/Anaerobic.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., Botany Practical Examinations at the End of Semester-IV**  
**(PLANT PHYSIOLOGY AND METABOLISM)**  
**Botany Practical Model Paper-IV (w.e.f 2022-23)**

**Time: 2 hours**

**Max. Marks: 50**

**1. Experiment 'A' Major experiment from Plant-Water relations / Plant metabolism      15M**

Scheme of valuation:

Aim, Principle and Procedure      -      5M

Conduct of Experiment      -      6M

Report of result and inference      -      4M

**2. Experiment 'B' Minor Experiment      7M**

Scheme of valuation:

Aim, Principle and Procedure      -      5M

Report of result and inference      -      2M

**3. Scientific observation and data analysis      4×5=20M**

**D. Plant-Water relations**

**E. Mineral nutrition and Enzymes**

**F. Plant metabolism**

**G. Plant growth and development**

Scheme of valuation:

Identification      -      1M

Diagram      -      1M

Reasons/analysis      -      1M

**4. Record & Viva-voce      5+3=08M**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II Year B.Sc., Degree Examinations at IV Semester End**  
**Botany Paper IV: PLANT PHYSIOLOGY & METABOLISM**  
**(Course: BO4207 Model Paper w.e.f. 2022-23)**

**Time: 2Hrs.**

**Max. Marks: 50**

**SECTION – A**

**3 × 10 =30 M**

Answer any **THREE** of the following by choosing atleast one question from each Part., draw neat and labeled diagrams wherever necessary

**PART – I**

1. a) Illustrate Transpiration? Describe the mechanism of opening and closing of stomata.  
OR  
b) Give an account on ascent of sap? Explain this biophysical process with Cohesion - Tension Theory.
2. a) Give an essay on general characters of Enzymes.  
OR  
b) Give a detailed note on biological nitrogen fixation in Rhizobium
3. a) Describe the mechanism of C3 Pathway.  
OR  
b) Give an account on Photophosphorylation.

**PART – II**

4. a) Give a detailed note on Glycolysis.  
OR  
b) Give an account on Electron transport system
5. a) Give a Detailed note on Photoperiodism  
OR  
b) General account on Phytohormones.
6. a) Give a detailed note on Photorespiration  
OR  
b) Give a detailed note on Electron transport chain

**SECTION – B**

**4 × 5=20 M**

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

1. Apoplast and symplast
2. Transcription
3. Photosynthetic pigments
4. Types of lipids
5. Role of Auxins in agriculture
6. Vernalisation



### **BLUE PRINT FOR QUESTION SETTER**

<b>UNIT NO/ TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>MARKS ALLOTTED TO THE MODULE</b>
<b>UNIT-I: PLANT - WATER RELATIONS</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-II : MINERAL NUTRITION &amp; ENZYMES</b>	<b>3</b>	<b>2</b>	<b>40</b>
<b>UNIT-III: PHOTOSYNTHESIS</b>	<b>3</b>	<b>1</b>	<b>35</b>
<b>UNIT-IV : PLANT RESPIRATION &amp; LIPID METABOLISM</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-V: GROWTH AND DEVELOPMENT</b>	<b>2</b>	<b>1</b>	<b>25</b>
Total marks allotted to all questions including choice			<b>150</b>

**Note:** Question paper setters are requested to adhere strictly to the above blue print while preparing the said paper

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., -Botany-IV/ IV Semester End (W.E.F. 2022-23)**  
**PLANT PHYSIOLOGY AND METABOLISM**  
**II B.Sc., -Botany-4/ IV Semester Question Bank**

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**UNIT – I: PLANT – WATER RELATIONS**

Essay Questions

1. Explain ascent of sap? Explain this biophysical process with Cohesion - Tension Theory.
2. Explain Transpiration? Describe the mechanism of opening and closing of stomata.
3. Describe the Mechanism of water absorption in plants. Add a note on factors affecting rate of water absorption.

Short notes.

1. Importance Water in Plant Metabolism
2. Apoplast and Simplast
3. Significance of Transpiration.

**UNIT –II: MINERAL NUTRITION & ENZYMES**

Essay Questions.

1. Electron Transport Chain
2. Krebs Cycle
3. Enzyme Kinetics

Short notes.

1. Classification of Enzymes
2. Absorption of mineral ions
3. Anaerobic Respiration

**UNIT –III: PHOTOSYNTHESIS**

Essay Questions.

1. Essay on Photophosphorylation.
2. Describe the mechanism of C<sub>3</sub> Pathway.
3. Describe photorespiration.

Short notes.

1. Difference between C<sub>4</sub> & CAM
2. Photosynthetic Pigments
3. Red drop Effect
4. Emerson enhancement effect.

**UNIT – IV: PLANT RESPIRATION & LIPID METABOLISM**

Essay Questions

1. Essay on Nitrogen metabolism
2. Explain the mechanism of symbiotic nitrogen fixation
3.  $\beta$  oxidation of lipids
4. Glyoxylate pathway

Short notes

1. Classification of lipids
2. Nitrogenase and hydrogenase enzymes
3. Anabolism of triglycerides
4. Transamination and deamination
- 5.

## **UNIT –V: GROWTH AND DEVELOPMENT**

Essay Questions.

1. Explain about biosynthesis and mode of action of phytohormones.
2. Give a Detailed note on Photoperiodism

Short notes.

1. Vernalisation.
2. Brassinosteroids.
3. Role of Auxins in Agriculture
4. Effect of salt stress on plants.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., -Botany- V Semester End (W.E.F. 2022-23)**  
**CELL BIOLOGY, GENETICS AND PLANT**  
**BREEDING**

Total hours of Teaching 40hrs @ 3 hrs/week

Total Credits:03

**UNIT – I: Cell Biology** (12h)

1. Cell, the unit of life- Cell theory, Prokaryotic and eukaryotic cells; Eukaryotic cell components.
2. Ultra structure and functions of cell wall and cell membranes.
3. Chromosomes: morphology, organization of DNA in a chromosome (nucleosome model), Euchromatin and heterochromatin, Special types of chromosomes- polytene, lampbrush,  $\beta$  chromosomes.

**UNIT – II: Genetic Material:** (12h)

1. DNA structure (Watson & Crick model) and replication of DNA (semi-conservative)
2. Types of RNA (mRNA, tRNA, rRNA), their structure and function.
3. Polymorphism of DNA.

**UNIT – III: Mendelian Inheritance:** (12h)

1. Mendel's laws of Inheritance (Mono- and Di- hybrid crosses); backcross and test cross.
2. Chromosomal mapping – 2-point & 3-point test cross.
3. Linkage: concept, complete and incomplete linkage, linkage mapping,
4. Crossing Over: concept & significance, Mitotic Crossing over.

**UNIT – IV: Plant Breeding:** (12h)

1. Introduction and Objectives of plant breeding.
2. Methods of crop improvement: Procedure, advantages and limitations of Introduction, Selection, and Hybridization (outlines only).
3. Heterosis

**UNIT – V: Breeding, Crop Improvement and Biotechnology:** (12h)

1. Role of mutations in crop improvement.
2. Role of soma clonal variations in crop improvement.
3. Molecular breeding – use of DNA markers in plant breeding and crop improvement (RAPD, RFLP).

**Suggested activity:** Seminar, Debate, Quiz, observation of live cells and nucleus in Onion peels, observation of Meiotic nuclei in Maize pollen. Solving Genetics problems.

### Books for Reference :

- Old, R.W. and Primrose S.B. 1994, Principles of Gene Manipulation Blackwell Science, London
- Grierson, D. and Convey S.N. 1989, Plant Molecular Biology, Blackie Publishers, New York.
- Lea, P.J. and Leegood R.C. 1999, Plant Biochemistry and Molecular Biology, John Wiley and Sons, London.
- Power C.B., 1984, Cell Biology, Himalaya Publishing Co. Mumbai
- De. Robertis and De Robertis, 1998, Cell and Molecular Biology, K.M. Varghese and Company
- Sinnott, E.W., L.C. Dunn & J. Dobshansky (1958): Principles of Genetics (5th Edition) McGraw Hill Publishing Co., N.Y. Toronto, London.
- Winchester, A.M. (1958): Genetics (3rd Edition) Oxford & IBH Publishing House, Calcutta, Bombay, New Delhi.
- Singleton, R. (1963): Elementary Genetics, D. Van Nostrand Co., Ltd., Inc., N.Y. & Affiliated East West Press (P) Ltd., New Delhi.
- Strickberger, M.W. (1976): Genetics (2nd Edition) MacMillan Publishing Co., Inc., N.Y., London
- Watson, J.D. (1977): Molecular Biology of the Gene, W.A. Benjamin, Inc., Menlo Park- California, Reading-Massachusetts, London, Amsterdam, Don Mills, Ontario, Sydney.
- Gardner, E.J & Snusted, D.P. (1984): Principles of Genetics (7th edition) John Wiley & Sons, N.Y. Chichester, Brisbane, Toronto, Singapore.
- Lewin, B. (1985) Genes VII Wiley Eastern Ltd., New Delhi, Bombay, Calcutta, Madras, Hyderabad.
- Allard R.W. (1999): The Principles of Plant Breeding, John & Wiley and Sons.
- Poelman J.M: Breeding Field Crops, Springer.
- George Acquah (2012): Principles of Plant Genetics & Breeding: Wiley-Blackwell.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., BOTANY PRACTICAL PAPER – V PRACTICAL SYLLABUS**  
**CELL BIOLOGY, GENETICS AND PLANT BREEDING**

Total hours of laboratory Exercises 45 hrs @ 2hrs/week

Total credits:02

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**PAPER – V PRACTICAL SYLLABUS**

**Suggested Laboratory Exercises:**

1. Study of the structure of cell organelles through photomicrographs.
2. Study of structure of plant cell through temporary mounts.
3. Study of various stages of mitosis using cytological preparation of Onion root tips.
4. Study of effect of organic solvent on permeability of cell membrane.
5. Numerical problems solving Mendel's Laws of inheritance
6. Chromosome mapping using 3-point test cross data.
7. Hybridization techniques – emasculation, bagging (for demonstration only).
8. Field visit to a plant breeding research station.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., Botany Practical Examinations at the End of Semester-V**  
**(CELL BIOLOGY, GENETICS AND PLANT BREEDING)**  
**Botany Practical Model Paper-V (w.e.f 2022-23)**

**Time: 2 hours**

**Max. Marks: 50**

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Perform the Experiment **A. Perform** squash on onion root tip, prepare the slide, identify at least one division stage. Write the procedure and draw the diagram of reported stage.

Describe the procedure of Hybridization technique **B**

1 x 15 = **15Marks**

Solving numerical problems on Mendelian inheritance **C, D**

1 x 10 = **10Marks**

Record & Viva

2 x 7.5 = **15Marks**

= **10Marks**

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**50 Marks**  
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A-Onion root squash technique

B- Emasculation & Bagging

C&D Numerical problems on Mendelian Inheritance.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III Year B.Sc., Degree Examinations at V Semester End**  
**Botany Paper V: CELL BIOLOGY GENETICS AND PLANT BREEDING**  
**(Course: BO5207 Model Paper w.e.f. 2022-23)**

**Time: 2Hrs.**

**Max. Marks: 50**

**SECTION – A**

**3×10 =30M**

Answer any **THREE** of the following by choosing atleast one question from each Part., draw neat and labeled diagrams wherever necessary.

**PART – I**

1. a) Give an account on Ultra structure and functions of cell membrane  
OR  
b) Give a detailed note on Organization of DNA in chromosome
2. a) Illustrate Watson & Crick model of DNA (OR) Explain about secondary structure of DNA  
OR  
b) Give a note on Replication of DNA especially Semiconservative model
3. a) Chromosome mapping (OR) 3 Point test cross  
OR  
b) Linkage concept and significance

**PART – II**

4. a) write about Methods of crop improvement  
OR  
b) Essay on Introduction and objectives of plant breeding
5. a) Explain the Role of Soma clonal variations  
OR  
b) Write an essay on Role of Mutations in crop improvement
6. a) Describe the ultra structure and functions of cell wall  
OR  
b) Write an essay on Molecular Breeding.

**SECTION – B**

**4×5=20M**

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

1. Difference between Prokaryotic and Eukaryotic cell
2. Euchromatin, Heterochromatin
3. m-RNA Structure and Functions
4. Test Cross
5. Crossing Over theories
6. Selection in Plant breeding



### **BLUE PRINT FOR QUESTION SETTER**

<b>UNIT NO/ TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>MARKS ALLOTTED TO THE MODULE</b>
<b>UNIT-I: CELL BIOLOGY</b>	<b>3</b>	<b>2</b>	<b>40</b>
<b>UNIT-II : GENETIC MATERIAL</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-III: MENDELIAN INHERITANCE</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-IV : PLANT BREEDING</b>	<b>2</b>	<b>1</b>	<b>25</b>
<b>UNIT-V: BREEDING, CROP IMPROVEMENT AND BIOTECHNOLOGY</b>	<b>3</b>	<b>1</b>	<b>35</b>
Total marks allotted to all questions including choice			<b>150</b>

**Note:** Question paper setters are requested to adhere strictly to the above blue print while preparing the said paper

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., -Botany-V / V Semester End (W.E.F. 2022-23)**  
**CELL BIOLOGY, GENETICS AND PLANT BREEDING**  
**III B.Sc., -Botany-5 / V Semester Question Bank**

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**UNIT – I: CELL BIOLOGY**

Essay Questions-

1. Describe the ultra structure and functions of cell wall?
2. Explain the organization of DNA in chromosome
3. Describe ultra structure and functions of cell membrane

Short Answer Questions

1. Cell theory
2. Difference between Prokaryotic and Eukaryotic cell
3. Fluid mosaic model of cell membrane
4. Euchromatin & Heterochromatin

**UNIT – II: GENETIC MATERIAL**

Essay Questions-

1. Watson & Crick model of DNA (OR) Explain about secondary structure of DNA
2. Replication of DNA especially Semiconservative model

Short Answer Questions

1. m-RNA Structure and Functions
2. t-RNA structure and Functions

**UNIT – III: MENDELIAN INHERITANCE**

Essay Questions-

1. Explain the Chromosome mapping (OR) 3 Point test cross
2. Linkage concept and significance

Short Answer Questions

1. Back cross
2. Test cross
3. Crossing Over theories

**UNIT – IV: PLANT BREEDING**

Essay Questions-

1. Methods of crop improvement
2. Essay on Introduction and objectives of plant breeding

Short Answer Questions

1. Objectives of Plant breeding
2. Selection in Plant breeding

## **UNIT – V: BREEDING, CROP IMPROVEMENT AND BIOTECHNOLOGY**

### Essay Questions-

1. Essay on Role of Mutations in crop improvement
2. Explain the Role of Somaclonal variations
3. Essay on Molecular Breeding

### Short Answer Questions

1. RFLP/Restriction Fragment Length Polymorphism
2. RAPD/ Rapid Amplified Polymorphic DNA
3. Hybridization of plant breeding
4. Significance of Mutations in Plant breeding

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., -Botany-VI / V Semester End (W.E.F. 2022-23)**

**ADVANCED ELECTIVE**

**PLANT TISSUE CULTURE**

Total hours of Teaching 40hrs @ 3 hrs/week

Total Credits:03

**Learning outcomes**

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

1. Comprehend the basic knowledge and applications of plant tissue culture.
2. Identified the various facilities required to set up a plant tissue culture laboratory.
3. Acquire a critical knowledge on Sterilization techniques related to plant tissue culture.
4. Demonstration skills of callus culture through hands on experience.
5. Understand the biotransformation technique for production of secondary metabolites.

**Unit - 1: Basic concepts of plant tissue culture (10h)**

1. Plant tissue culture: Definition, history, scope and significance.
2. Totipotency, differentiation, dedifferentiation, and redifferentiation; Organ culture types of cultures.
3. Infrastructure and equipment required to establish a tissue culture laboratory.

**Unit - 2: Sterilization techniques and culture media (10h)**

1. Aseptic conditions – Fumigation, wet and dry sterilization, UV sterilization, ultrafiltration.
2. Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids etc.
3. Composition and preparation of Murashige and Skoog culture medium.

**Unit - 3: Callus culture technique (10h)**

1. Explant: Definition, different explants for tissue culture: shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs, their isolation and surface sterilization; inoculation methods.
2. Callus culture: Definition, various steps in callus culture.
3. Initiation and maintenance of callus - Growth measurements and subculture; some clonal variations.

**Unit – 4: Micropropagation (10h)**

1. Direct and indirect morphogenesis, organogenesis, role of PGRs; somatic embryogenesis and synthetic seeds.
2. Greenhouse hardening unit operation and management; acclimatization and hardening of plantlets - need, process, packaging, exports.
3. Pathogen (Virus) indexing- significance, methods, advantages, applications.

**Unit – 5: Applications of plant tissue culture (10h)**

1. Germplasm conservation: cryopreservation methods, slow growth, applications and limitations; cryoprotectants.

2. Plant transformation techniques and bioreactors; production of secondary metabolites-optimization of yield, commercial aspects, applications, limitations.
3. Transgenic plants- gene transfer methods; BT cotton.

## **I. References:**

1. Kalyan Kumar De (2001) An Introduction to Plant Tissue Culture, New Central Book Agency (P) Ltd., Calcutta
2. Razdan, M.K. (2005) Introduction to Plant Tissue Culture, Oxford & IBH Publishers, Delhi
3. Bhojwani, S.S. (1990) Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.
4. Vasil, I.K. and Thorpe, T.A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands.
5. Web resources suggested by the teacher concerned and the college librarian including reading material.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., BOTANY PRACTICAL**  
**PAPER – VI PRACTICAL SYLLABUS**  
**PLANT TISSUE CULTURE**

Total hours of laboratory Exercises 45 hrs @ 2hrs/week

Total credits:03

**I. Learning Outcomes:** On successful completion of this practical course, student will be able to:

1. List out, identify and handle various equipment in plant tissue culture lab.
2. Learn the procedures of preparation of media.
3. Demonstrate skills on inoculation, establishing callus culture and Micro propagation.
4. Acquire skills in observing and measuring callus growth.
5. Perform some techniques related to plant transformation for secondary Metabolite production.

**II. Practical (Laboratory) Syllabus:** (30 hrs)

1. Principles and applications of- Autoclave, Laminar Airflow, Hot Air Oven.
2. Sterilization techniques for glass ware, tools etc.,
3. MS medium - Preparation of different stock solutions; media preparation
4. Explant preparation, inoculation and initiation of callus from carrot.
5. Callus formation, growth measurements.
6. Induction of somatic embryos, preparation of synthetic seeds.
7. Multiplication of callus and organogenesis.
8. Hardening and acclimatization in green house.

**II. Lab References:**

1. Reinert, J. and M.M. Yeoman, 1982. Plant Cell and Tissue Culture - A Laboratory Manual, Springer-Verlag Berlin Heidelberg
2. Robert N. Trigiano and Dennis J. Gray, 1999. Plant Tissue Culture Concepts and Laboratory Exercises. CRC Press, Florida
3. Ashok Kumar, 2018. Practical Manual for Biotechnology, College of Horticulture & Forestry, Jhalawar, AU, Kota
4. Chawla, H.S., 2003. Plant Biotechnology: A Practical Approach, Nova Science Publishers, New York
5. Web sources suggested by the teacher concerned.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., Botany Practical Examinations at the End of Semester-V**  
**(PLANT TISSUE CULTURE)**  
**Botany Practical Model Paper-VI (w.e.f 2022-23)**

**Time: 2 hours**

**Max. Marks: 50**

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- |  |            |
|--|------------|
| 1. Demonstration of a sterilization technique 'A'                    | 8          |
| 2. Preparation of MS medium 'B'                                      | 10         |
| 3. Demonstration of callus culture technique/growth measurements 'C' | 12         |
| 4. Scientific observation and data analysis                          | 4 x 3 = 12 |
| D. Tissue culture equipment /photograph                              |            |
| E. Morphogenesis or organogenesis - photograph                       |            |
| F. Bioreactor/Secondary metabolite                                   |            |
| G. Transgenic plant/photograph                                       |            |
| 5. Record + Viva-voce  | 5+3=8      |



**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III Year B.Sc., Degree Examinations at V Semester End**  
**Botany Paper VI: PLANT TISSUE CULTURE**  
**(Course: BO5207 Model Paper w.e.f. 2022-23)**

**Time: 2 ½ Hrs.**

**Max. Marks: 60**

**SECTION – A**

**3×10 =30M**

Answer any **THREE** of the following by choosing atleast one question from each Part., draw neat and labeled diagrams wherever necessary.

**PART – I**

1 a) Describe the equipments used in tissue culture

OR

b) write about Organ culture in tissue culture

2 a) Write about sterilization methods

OR

b) Ingredients and its advantages used in the preparation of tissue culture medium

3 a) Illustrate the various steps involved in callus culture

OR

b) Give a detailed note on Somaclonal variations

**PART – II**

4 a) Give a detailed note on Pathogen indexing-methods, Significance & Advantages

OR

b) Write an essay on Somatic embryogenesis.

5 a) General account on Germplasm Conservation & its significance

OR

b) Applications of plant tissue culture

**SECTION – B**

**4×5 =20M**

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

6. Totipotency
7. Production of Haplod plants
8. Role of hormones in tissue culture
9. Ultrafiltration
10. Shoot tip culture
11. Growth measurements
12. Organogenesis
13. Bt-Cotton

**SECTION – C**

**5×2 =10M**

Answer any 5 Questions

- 1.Plant tissue culture
- 2.Redifferentiation
- 3.Autoclave
- 4.Fumigation
- 5.Explant
- 6.callus culture
- 7.Synthetic seeds
- 8.Organogenesis
- 9.Cryoprotectants
- 10.Transgenic plants

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., -Botany-VI / V Semester End (W.E.F. 2022-23)**  
**PLANT TISSUE CULTURE**  
**III B.Sc., -Botany-6 / V Semester Question Bank**

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**UNIT – I: BASICS CONCEPTS OF PLANT TISSUE CULTURE:**

**Essay Questions**

1. Describe the equipments used in tissue culture.
2. Write about Organ culture.

**Shorts**

1. Totipotency
2. Differentiation, Dedifferentiation & Redifferentiation
3. Production of Haploids

**Very short Questions**

1. Plant tissue culture
2. Totipotency
3. Dedifferentiation
4. Redifferentiation

**Unit - 2: Sterilization techniques and culture media**

**Essays Questions**

1. Write about Sterilization Methods
2. General account on Ingredients and its advantages used in the preparation of tissue culture media

**Shorts Questions**

1. Role of hormones in Tissue culture
2. Fumigation
3. Ultra filtration
4. Heat sterilization

**Very short Questions**

1. Autoclave
2. Incineration
3. Flaming
4. Fumigation

**Unit - 3: Callus culture technique**

**Essays Questions**

1. Explain callus culture
2. Essay on Somaclonal variation

**Shorts Questions**

1. Shoot tip culture
2. Growth Measurements
3. Subculturing
4. Floral organ isolation & Sterilization

**Very short Questions**

1. Explant
2. callus culture
3. axillary bud culture

**Unit – 4 : Micropropagation**

**Essays Questions**

1. Illustrate Somatic embryogenesis
2. Pathogen indexing
3. Green house hardening unit operation & management

**Shorts Questions**

- 1.Organogenesis
- 2.role of PGR in plant tissue culture
- 3.Synthetic seeds
- 4.Packaging & Export of hardening plantlets
- 5.Pathogen indexing

**Very short Questions**

- 1.Somatic Embryogenesis
- 2.Synthetic seeds
- 3.Hardening
- 4.Pathogen indexing
- 5.Acclimatization
- 6.Organogenesis

**Unit –5 : Applications of Plant tissue culture****Essays Questions**

- 1.General account on Germplasm Conservation & its significance
- 2.Detailed note on Production of secondary metabolites
- 3.Transgenic plants

**Shorts Questions**

- 1.Cryopreservation
- 2.Germplasm Conservation
- 3.BT-cotton
- 4.Bioreactors

**Very short Questions**

- 1.Cryoproteins
- 2.Cryoprotectants
- 3.Secondary metabolites
- 4.Bioreactors
- 5.Agrobacterium mediated gene transfer
- 6.Transgenic plants

**BLUE PRINT FOR QUESTION PAPER SETTER**

<b>UNIT NO/ TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>VSAQ</b>	<b>MARKS ALLOTTED TO THE MODULE</b>
<b>UNIT-I: BASIC CONCEPTS OF PLANT TISSUE CULTURE</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>34</b>
<b>UNIT-II : STERILIZATION TECHNIQUES AND CULTURE MEDIA</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>34</b>
<b>UNIT-III: CALLUS CULTURE TECHNIQUE</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>34</b>
<b>UNIT-IV : MICROPROPAGATION</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>29</b>
<b>UNIT-V: APPLICATIONS OF PLANT TISSUE CULTURE</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>29</b>
Total marks allotted to all questions including choice				<b>160</b>

**NOTE:** Question paper setters are requested to adhere strictly to the above blue print while preparing their said paper

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., -Botany-VII/ VI Semester End (W.E.F. 2022-23)**  
**ADVANCED ELECTIVE**

**MUSHROOM CULTIVATION**

**(Course: BO6209)**

Total hours of Teaching 40hrs @ 3 hrs/week

Total Credits:03

**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 mushroom.
2. Identify the basic infrastructure to establish a mushroom culture unit.
3. Demonstrate the 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.

**Unit – 1: Introduction and value of mushrooms (10h)**

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.
2. Morphological features of any four edible mushrooms, Button mushroom (*Agaricus Bosporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor-caju*) and Paddy straw mushroom (*Volvariella volvacea*).
3. Nutraceutical value of mushrooms; medicinal mushrooms in South India - *Ganoderma lucidum*, *Phellinus rimosus*, *Pleurotus florida* and *Pleurotus pulmonaris* – their therapeutic value; Poisonous mushrooms - harmful effects.

**Unit – 2: Basic requirements of cultivation system (10h)**

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 (10h)**

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** (10h)

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

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

#### **Unit – 5: Post harvest technology** (10h)

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.

## **I. References:**

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. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
6. Pathak V.N., Nagendra Yadav and Maneesha Gaur (2000), Mushroom Production and Processing Technology Vedams Ebooks Pvt. Ltd., New Delhi
7. Web resources suggested by the teacher concerned and the college librarian including reading material.



**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**III B.Sc., BOTANY PRACTICAL PAPER – VII PRACTICAL SYLLABUS**

**MUSHROOM CULTIVATION**

Total hours of laboratory Exercises 45 hrs @ 2hrs/week

Total credits:03

**Learning Outcomes:**

On successful completion of this practical course, student will 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. Practical (Laboratory) Syllabus:**

(30 hrs)

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.

**III. Lab References:**

1. Sushma Sharma Sapna Thakur Ajar Nath Yadav, 2018. Mushroom Cultivation: A Laboratory Manual, Eternal University, Sirmour, H.P.
2. Kadhila-Muandingi, N.P., F. S. Mubiana and K. L. Halueendo, 2012. Mushroom Cultivation: A Beginners Guide, The University of Namibia
3. Gajendra Jagatap and Utpal Dey, 2012. Mushroom Cultivation: Practical Manual, LAMBERT Academic Publishing, Saarbrücken, Germany
4. Deepak Som, 2021. A Practical Manual on Mushroom Cultivation, P.K.Publishers & Distributors, Delhi
5. Web sources suggested by the teacher concerned.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**III B.Sc., Botany Practical Examinations at the End of Semester-VI**

**MUSHROOM CULTIVATION**

**Botany Practical Model Paper-VII (w.e.f 2022-23)**

**Time:2 hrs**

**max marks: 50**

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- |  |            |
|--|------------|
| 1. Demonstration of preparing pure culture/mother spawn 'A'                          | 8          |
| 2. Preparation method for planting spawn and storage/compost and casing material 'B' | 10         |
| 3. Demonstration of spawning and casing/storage and making a value-added product 'C' | 12         |
| 4. Scientific observation and data analysis  | 4 x 3 = 12 |
| D. Edible/poisonous mushroom specimen/photograph                                     |            |
| E. Infrastructure/tool used in mushroom cultivation                                  |            |
| F. Material for compost/casing   |            |
| G. Storage practice/ a value-added product   |            |
| 5. Record + Viva-voce  | 5+3 = 8    |

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III Year B.Sc., Degree Examinations at V Semester End**  
**Botany Paper VII: MUSHROOM CULTIVATION**  
**(Course: BO5207 Model Paper w.e.f. 2022-23)**

**Time: 2 ½ Hrs.**

**Max. Marks: 60**

**SECTION – A**

**3×10 =30M**

Answer any **THREE** of the following by choosing atleast one question from each Part., draw neat and labeled diagrams wherever necessary.

**PART – I**

- 1 a) Explain morphological features of edible mushrooms (Agaricus biosporous & Calocybe indica)

OR

- b) Brief account on life cycle of Mushroom

- 2 a) Write an essay on layout of mushroom farm.

OR

- b) Give an account on methods of composting

- 3 a) Define spawn and explain the facilities required for spawning

OR

- b) Give a detailed note on casing. Explain the benefits, types and other materials of casing.

**PART – II**

- 4 a) Essay on the production of button mushrooms.

OR

- b) Essay on cultivation of Milk mushroom & paddy straw mushroom

- 5 a) Detailed note on preservation of mushrooms

OR

- b) .What is shelf life of a mushroom ? What are the conditions required to improve shelf life of a mushroom

**SECTION – B**

**4×5 =20M**

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

6. Write the difference between poisonous & harmful mushrooms
7. Importance of mushroom cultivation
8. Write a note on factors affecting composting.
9. Write a short note on design of cropping room.
10. What are the characteristics of a good spawn.
11. Define casing. Why is casing necessary.
12. .Give an account of nematodes associated with mushroom cultivation.
13. Value added products of mushrooms.

**SECTION – C**

**5×2 =10M**

Answer any 5 Questions

1. Define mushroom
2. composting
3. Casing
4. Spawning
5. Dry Freezing
6. Pasteurization.
7. Bulk chamber
8. Storage of spawn
9. Raw material for mushroom cultivation
10. Canning.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc., -Botany-VII / V Semester End (W.E.F. 2022-23)**  
**MUSHROOM CULTIVATION**  
**III B.Sc., -Botany-7 / V Semester Question Bank**

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**UNIT – I:INTRODUCTION AND VALUE OF MUSHROOM**

**Essay Questions**

1. Brief account on life cycle of Mushroom
2. Explain morphological features of edible mushrooms (Agaricus biosporous & Calocybe indica)
3. Illustrate the nutaceutical and medicinal values of mushrooms.

**Short Questions**

1. Write the difference between poisonous & harmful mushrooms
2. Write a short note on Pleurotus florida
3. Importance of mushroom cultivation

**Very Short Questions**

1. Define mushroom
2. Ganoderma lucidium
3. milky mushroom
4. paddy straw mushroom
5. oyster mushroom

**UNIT – II: BASIC REQUIREMENTS OF CULTIVATION SYSTEM**

**Essay Questions**

1. Write an essay on layout of mushroom farm.
2. What is composting? Write an essay on need and advantages of composting.
3. Give an account on methods of composting

**Short Questions**

1. Write short note on materials required for compost preparation.
2. Write a note on factors affecting composting.
3. Write a short note on design of cropping room.

**Very Short Questions**

1. composting.
2. bulk chamber.
3. Pasteurization.
4. Growing room.

**UNIT – III: SPAWNING AND CASING**

**Essay Questions**

1. Define spawn and explain the facilities required for spawning
2. Give a detailed note on casing. Explain the benefits, types and other materials of casing.

**Short Questions**

1. Define casing. Why is casing necessary.
2. What are the characteristics of a good spawn.
3. Preparation of pure culture.

**Very Short Questions**

1. spawn
2. casing
3. quality parameters of casing soil
4. storage of spawn

**UNIT – IV: MUSHROOM CULTIVATION**

**Essay Question**

1. Essay on the production of button mushrooms.
2. Essay on production of oyster mushroom

3. Essay on cultivation of Milk mushroom & paddy straw mushroom

**Short Questions**

1. Write a short notes on post harvest management in button mushrooms.
2. Give an account of nematodes associated with mushroom cultivation.
3. Write note on post harvest handling of fresh oyster mushroom.
4. Write note on post harvest handling of fresh milky mushroom.

**Very Short Questions**

1. raw material for mushroom cultivation
2. spawning
3. cropping
4. pests & nematodes of mushroom cultivation

**UNIT – V: POST HARVEST TECHNOLOGY**

**Essay Question**

1. Detailed note on preservation of mushrooms
2. What is shelf life of a mushroom ? What are the conditions required to improve shelf life of a mushroom.

**Short Questions**

1. Shelf life of mushrooms
2. canning of mushrooms
3. Value added products of mushrooms

**Very Short Questions**

1. Drying method.
2. Freeze preservation.
3. Canning.

### **BLUE PRINT FOR QUESTION PAPER SETTER**

<b>UNIT NO/ TITLE</b>	<b>LAQ</b>	<b>SAQ</b>	<b>VSAQ</b>	<b>MARKS ALLOTTED TO THE MODULE</b>
<b>UNIT-I: INTRODUCTION AND VALUE OF MUSHROOM</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>34</b>
<b>UNIT-II : BASIC REQUIREMENTS OF CULTIVATION SYSTEM</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>34</b>
<b>UNIT-III: SPAWNING AND CASING</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>34</b>
<b>UNIT-IV : MUSHROOM CULTIVATION</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>29</b>
<b>UNIT-V: POST HARVEST TECHNOLOGY</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>29</b>
Total marks allotted to all questions including choice				<b>160</b>

**NOTE:** Question paper setters are requested to adhere strictly to the above blue print while preparing their said paper

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**CERTIFICATE COURSE FOR BOTANY**

**TITLE : Mushroom Cultivation**

**2022-23**

**B.Sc, BZC, MBC, HBC For I,II III Years**

**Total Hours :30Hours**

**Credits :2**

Department of Botany will be going to conduct 45 days certificate course on or before 28/02/2022 . certificate issued after completion of the course (assessment necessary for certificate)

**Purpose of the course or course out comes** ; Self employment ,

To encourage the small scale industry, To Earn additional income

- 1) **Qualifications** : Degree
- 2) **Course** : MUSHROOM CULTIVATION
- 3) **Medium** : English
- 4) **Course duration** : 45 hrs. from 01/02/2022 to 28/02/2022
- 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, Mrs.Sara Palaparthi &  
Dr M.Krishna Rao.
- 10) **Fee** : exam fee Rs 200/-



**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**DEPARTMENT OF BOTANY**

Total hours of instructions and practicals-45

**CERTIFICATE COURSE**

**MUSHROOM CULTIVATION**

syllabus

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<b>UNIT –I</b>	(9 hrs)
Introduction- history- scope of edible mushroom cultivation Types of mushrooms available in India Poisonous mushrooms.	
<b>UNIT-2</b>	(9 hrs)
Spawn preparation- sterilization, multiplication	
<b>UNIT-3</b>	(9 hrs)
Cultivation- locally available vessels, -compost preparation inoculation, culture rack – water sprayer, tray, -mushroom bed preparation –factors –harvesting.	
<b>UNIT-4</b>	(9 hrs)
Storage-short term storage (Refrigeration – up to 24 hrs) – long term storage (canning, pickels, papads), drying, storage in salt solutions	
<b>HANDS ON TRAINING &amp; PRACTICALS</b>	(9 hrs)
<b>Field visit (with your own expenses)</b>	<b>1 day</b>

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**DEPARTMENT OF BOTANY**  
Total hours of instructions and practicals-45  
**CERTIFICATE COURSE**  
**MUSHROOM CULTIVATION**  
syllabus

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<b>Question paper</b> – (2 questions from each section, answer any one) (Each section carries 10 marks)	<b>40 marks</b>
<b>Project work</b> -	<b>20 marks</b>
<b>Assignments</b>	<b>10 Marks</b>
<b>Practical -</b>	<b>30 marks</b>
<b>Total</b>	----- <b>100 marks</b> -----

## **PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

The **Board of Studies in B.Sc BOTANY** for the academic year 2022-2023 held in November 2022 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- External evaluation and 50- Internal evaluation for I, II, III, IV, Semesters 60- External evaluation and 40- Internal evaluation for V & VI<sup>th</sup> Semesters for complete Internship
3. Conduct of Semester End Practical examinations for I, II, & III Years
4. Approval of compulsory projects for III Year Cluster paper
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 2022-23.
7. Approval of 1<sup>st</sup> year I & II semesters syllabus with theory & practicals will be finalized by following APSCHE guidelines in coming one or two months.
8. Approval of NPTEL courses to all B.Sc Botany students
9. Approval of Hands on training programs on mushroom cultivation to B.Sc Botany final year students.
10. Approval of changes made upto 20%

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 Adikavi Nannaya University from the Academic year 2022-23.
2. Resolved Ist Year I & II Semesters syllabus with theory & Practical will be finalized by following APSCHE guidelines in coming one or two months.
3. Resolved to adopt 50 External, 50 Internal evaluations for all 3 Years students , 60 External and 60 Internal for V&VI semester, Internship
4. Resolved to conduct practical 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 change the syllabus upto 20%.

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*Abhishek*

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