

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

**2024-2025**

**DEPARTMENT OF BOTANY**

**SYLLABUS FOR B.Sc BOTANY Honours**  
**&**  
**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 2024-2025 is conducted at the Department of Botany on 30-04-2024 with Dr.M.Krishna Rao, Lecturer in-Charge in the chair along with the following members

Name, Designation and Address

Signature

**1. Chair Person:**

**Dr. M.Krishna Rao**

Lecturer in-charge

Dept. of BOTANY

P.R.G.C.(A), Kakinada

*M.K.Rao*  
30/4/24

**2. Adikavi Nannaya University Nominee:**

**Dr. J.SUNITHA,**

Principal GDC Kovvur

Mobile: 9441050910

E-mail: drjsuneetha@gerjy.ac.in

*online*

**3. Members Nominated by Executive Council of the College:**

**A. Subject Expert 1:**

**Dr. A.Srinivas Rao**

Lecturer incharge

Department of Botany

Government Arts College, Rajahmundry

Mobile: 9985076306

Email.Id:- drannabattulasrao@gmail.com

*online*

**B. Subject Expert 2:**

**Mrs.P.Sara**

Lecturer incharge Botany

GDC, Ramachandrapuram

Mobile: 7386379223

**C. Member from Research Organization:**

**Smt P.SWATHI**

Assistant Director,

Dept. of Agriculture, Pithapuram

Mobile: 9848350962

E-Mail: swathi3002@yahoo.com

*Swathi*  
30/4/24

PRGC BOTANY BOS 24-25

PRGC BOT BOS 2024-25

Name, Designation and Address

Signature

Alumni Member:

**Dr. D R SALOMI SUNEETHA**  
Professor & Head  
Dr YSR Horticultural University  
Venkatramannagudem-534101  
W.G Dist  
Mobile: 9491608088  
Email: salomibiochem@gmail.com

*Online*

**I. Members from the College:**

**A. Faculty member:**

1. **Dr. Ch. JOHN SAMUEL**  
Lecturer in Botany  
PRGC(A), Kakinada
2. **M.V.V.S.Ganga Bhavani**  
Guest faculty in Botany
3. **N.Deepika**  
Guest faculty in Botany
4. **M.S.S.Parvathi**  
Guest faculty in Botany
5. **G.Mispa kumari**  
Guest faculty in Botany
6. **V.David Samson**  
Guest faculty in Botany

*M. Ganga Bhavani*

*N. Deepika*

*M. S. S. Parvathi*

*Dr. Mispa Kumari*

*V. David Samson*

**B.STUDENT MEMBERS**

1. M. Angel Tejaswi  
II B.Sc MBC
2. B.A.N.V.B.Savithri  
I B.Sc Hons Botany
- 3.R.Rajya Lakshmi  
I B.Sc Hons Botany

*M. Angel Tejaswi*

*B.A.N.V.D. Savithri.*

*R. Rajyalaxmi*

**C. Parent Member**

1. M. Rajendra Babu  
Ph.no:-7981019361

*M. Rajendra Babu*  
*- 90/04/2024*

# 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.

<i>Sno</i>	<i>PS</i>	<i>Pedagogic Strategy/Method</i>	<i>Practice</i>	<i>Advantages</i>
1	P1	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	P8	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	P9	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	P10	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 **P<sub>x</sub>**

for any of these additional strategies in the teaching plans, cycles and matrices.

<i>Sno</i>	<i>Pedagogic Strategy/Method</i>	<i>Practice</i>	<i>Advantages</i>
1	Quiz	Small student teams competeto answer random questions from the quiz master	Best used for extractingprecise but dispersed information
2	Brainstorming	A small or large group of students gather their ideas onnew concepts or aspects	Useful in preparing curious background for a new item of learning. . A soft skill isinculcated.
3	Role Play	Students take the role of actual persons in the field andenact the process	Creates a sense of understanding leading to responsible learning. . A softskill 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 thebest ways of problem solving. Use of ICT will enhance the outcomes.
5	Peer review	A group of students reviewing the work of other students andalso that of authors	Trains in developing insights for better understanding andjudging
6	Games & Puzzles	Students solving subject related problems through available game models of designing their own models	Strengthens problem solvingtraits and invokes use of intelligence
7	Tutorial	Teacher interacting with smallgroups 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		

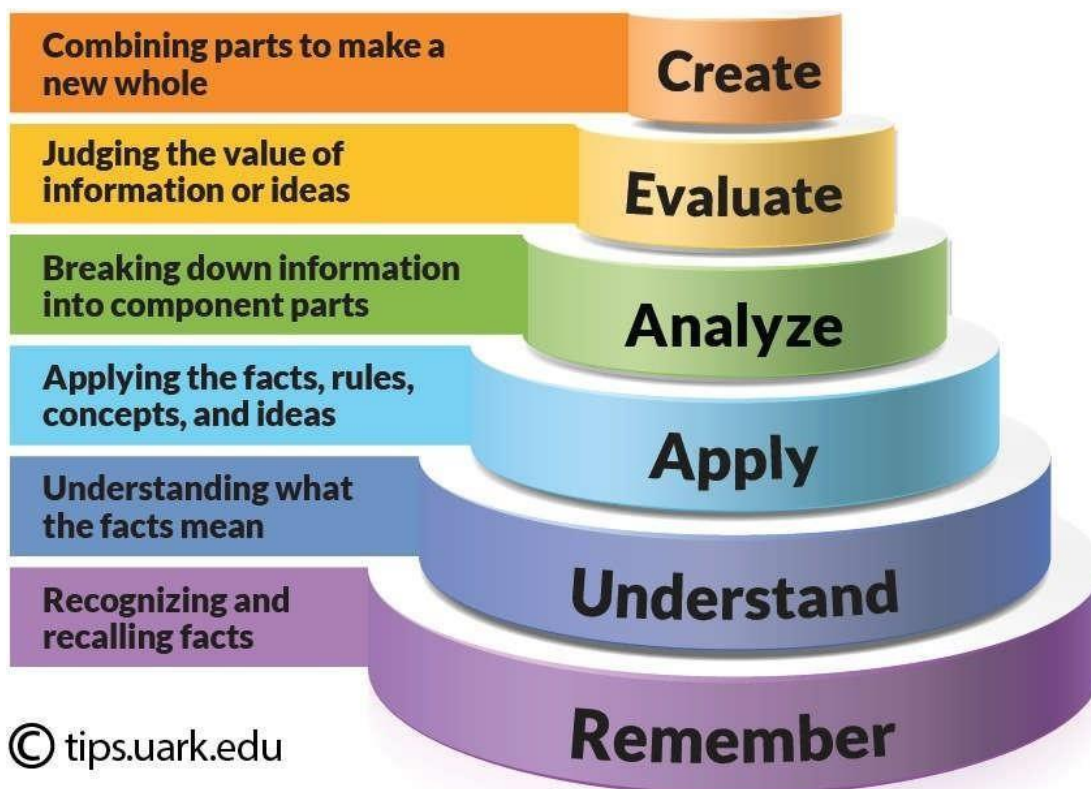
### I. Outline Model Pedagogic Strategy Cycle:

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.

## BLOOMS REVISED TAXONOMY





which thinkers encounter and work with knowledge:

- **Remember**
  - Recognizing
  - Recalling
- **Understand**
  - Interpreting
  - Exemplifying
  - Classifying
  - Summarizing
  - Inferring
  - Comparing
- **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 & B.Sc honours 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 Physiology, genetics, Taxonomy, anatomy, embryology, Ecology, tissue culture & mushroom cultivation.

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

**COURSE OUTCOMES**

**SEMESTER - 1**

CO1: Learn the principles of classification and preservation of biodiversity

CO2: Understand the plant anatomical, physiological and reproductive process

CO3: knowledge created on classification of animals

CO4: outline the cell components, cell process like cell division, heredity and molecular process

CO5: Comprehend the chemical principles in shading and driving the macromolecules and life processes

**SEMESTER – 2**

CO1: Compile the general characteristics of Algae and their significance

CO2: Summarize the characteristics of fungi and their economic importance

CO3: Elaborate the features and significance of amphibians of plant kingdom

CO4: Explain the diversity among non vascular plants.

CO5: knowledge on diversity of microbes.

**SEMESTER – 3**

CO1: Organization of tissues and tissue systems in plants

CO2: Illustrate and interpret various aspects of embryology

CO3: Basics concepts of plant ecology

CO4: Correlate the importance of biodiversity and consequence due to its loss.

CO5: Enlist the endemic/endangered flora and fauna.

**SEMESTER – 4**

CO1: knowledge about the metabolism of plant

CO2: awareness of absorption of water in plants

CO3: knowledge on cell and its components

CO4: knowledge on heredity, inheritance in genetics

CO5: knowledge on plant breeding techniques

**SEMESTER – 5**

CO1: Basic knowledge and applications of plant tissue culture

CO2: Identified various techniques to set up a tissue culture lab

CO3: Understand the bioinformatics techniques for secondary metabolite production

CO4: knowledge on structure and life cycle of mushrooms.

CO5: Acquire critical knowledge on cultivation of edible mushrooms.

S. No.	Semester	Title of the Course(Paper)	Hours /week	Max. Marks (SEE)	Marks in CIA	Credits
1.	Sem.-I/ Course-1-major	Introduction to Classical Biology	02	50	50	04
2.	Sem.-II/ Course-3-major/ Minor	Non Vascular Plants	03	50	50	03
	Course-3 Major/ Minor practical	Non Vascular Plants	02	Max. Marks-50 Internal assessment at Semester end		01
	Sem.-II/ Course-4-major	Origin of life and diversity of microbes	03	50	50	03
	Course-4 practical	Origin of life and diversity of microbes	02	Max. Marks- 50 Internal assessment at Semester end		01
3.	Sem -III Course-5 Major/ minor	Vascular Plants	03	50	50	03
	Sem -III Course-5 Major/ minor practical	Vascular Plants	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -III Course-6 Major	Plant Pathology and Plant Diseases	03	50	50	03
	Sem -III Course-6 Major/practical	Plant Pathology and Plant Diseases	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -III Course-7 Major	Plant Breeding	03	50	50	03
	Sem -III Course-7 Major practical	Plant Breeding	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -III Course-8 Major	Plant Biotechnology	03	50	50	03
	Sem -III Course-8 Major/practical	Plant Biotechnology	02	Max. Marks- 50 Internal assessment at Semester end		01

4	Sem -IV Course-9 Major/Minor	Anatomy and Embryology of Angiosperms	03	50	50	03
	Sem -IV Course-9 Major/Minor practical	Anatomy and Embryology of Angiosperms	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -IV Course-10 Major/Minor	Plant Ecology, Biodiversity and Phytogeography	03	50	50	03
	Sem -IV Course-10 Major/Minor practical	Plant Ecology, Biodiversity and Phytogeography	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -IV Course-11 Major	Plant Resources and Utilization	03	50	50	03
	Sem -IV Course-11 Major practical	Plant Resources and Utilization	02	Max. Marks- 50 Internal assessment at Semester end		01
5	Sem -V- Paper 6B Major	Vegetable Crops – Cultivation Practices	04	50	50	03
	Sem -V - Paper 6B Major practical	Vegetable Crops – Cultivation Practices	02	Max. Marks- 50 Internal assessment at Semester end		01
	Sem -V- Paper 7B Major	Vegetable Crops – Post Harvest Practices	04	50	50	03
	Sem -V - Paper 7B Major practical	Vegetable Crops – Post Harvest Practices	02	Max. Marks- 50 Internal assessment at Semester end		01
6	SEM VI	<b>LONG TERM INTERNSHIP (APPRENTICESHIP)</b>				

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE [A]:: KAKINADA  
PLAN OF ACTION FOR AY 2024-25**

**DEPARTMENT:BOTANY & HORTICULTURE**

S.No	Activity planned	Dates/ Period
1	National/International Conference	4-07-2024 TO 05-07-2024
2	Monthly Examinations on competitive examination lines	Monthly
3	Certificate course-1 ( CONDUCT ATLEAST ONE IN THE ACADEMIC YEAR)	AUGUST
4	Value added course -1	AUGUST
5	Diploma course - 1	SEPTEMBER
6	Guest Lectures - 4	AUGUST & NOVEMBER
7	Workshop	OCTOBER
8	MoUs - 3 ( Target)	In 2024-25
11	Research publications - 5 ( target)	2024-25
12	Community Outreach programs: ( I Pogram is mandatory in the semester)	One in each Semester
13	Plantation of saplings in Adopted village	DECEMBER
14	Best Practices	2024-25
15	Field trip	OCTOBER AND JANUARY

**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. 2024 - 25 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)	7	5	35	4	5	20
<b>Total Questions &amp; Total Marks =</b>		<b>13</b>	<b>-</b>	<b>95</b>	<b>7</b>	<b>-</b>	<b>50</b>

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

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc.Honours -Botany-Major / I Semester End (W.E.F. 2024-25)**

**INTRODUCTION TO CLASSICAL BIOLOGY**

**Hours/Week: 5**

**Credits: 4**

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**Learning objectives**

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

**Learning Outcomes**

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

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

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

**Unit 2: Essentials of Botany.**

- 2.1. The classification of plant kingdom.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4. Mushroom cultivation, floriculture and landscaping.

**Unit 3: Essentials of Zoology**

- 3.1. The classification of Kingdom Animalia and Chordata.

- 3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

#### **Unit 4: Cell biology, Genetics and Evolution**

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
- 4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
- 4.3. Central Dogma of Molecular Biology.
- 4.4. Origin of life

#### **Unit 5: Essentials of chemistry**

- 5.1. Definition and scope of chemistry, applications of chemistry in daily life.
- 5.2. Branches of chemistry
- 5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.
- 5.4. Green chemistry

#### **References**

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2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4<sup>th</sup> edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4<sup>th</sup> Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Satyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5<sup>th</sup> Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1<sup>st</sup> Edition. Oxford publishers.

## **ACTIVITIES:**

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I Year B.Sc. HONOURS BOTANY**  
**Examinations at I Semester End**  
**Botany Paper I: INTRODUCTION TO CLASSICAL BIOLOGY**  
**(2024-25)**

**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. Define taxonomy and its Hierarchy
2. Detailed note on photosynthesis.
3. Explain hormones and its disorders

**PART- II**

4. Explain cell cycle in detail
5. Detailed note on Branches of chemistry
6. Write a note on Mushroom Cultivation

**SECTION – B**

Answer any **FOUR** of the following questions. Each question carries **5** marks **4 X 5 = 20 M**


7. Binomial Nomenclature
8. Rules of ICBN and ICZN
9. Structure of flower
10. Fertilization
11. Gametogenesis
12. Difference between prokaryotic and eukaryotic cell
13. Covalent bond

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc., -Botany/ I Semester End (W.E.F. 2024-25)**  
**Course 1 :- Introduction to Classical Biology**  
**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Sem ester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employabili ty/entrepre nuership)</b>
1	Botany	I	Introduction to classical Biology	Introduction to systematics, taxonomy and ecology	Knowledge	Lecture & Field Visit	Skill
2	Botany	I	Introduction to classical Biology	Essentials of Botany	Knowledge	Shall be shown by Photographs & models	Skill
3	Botany	I	Introduction to classical Biology	Cell Biology, Genetics & Evolution	Knowledge	Shall be shown by Photographs & models	Skill

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> I B.Sc. Honours (I Semester)			
Course 1	<b>TITLE OF THE COURSE</b> <b>Introduction to Classical Biology</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	4

### Course Objectives

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

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Learn the principles of classification and preservation of biodiversity
CO2	Understand the plant anatomical, physiological and reproductive processes.
CO3	Knowledge on animal classification, physiology, embryonic development and their economic importance.
CO4	Outline the cell components, cell processes like cell division, heredity and molecular processes.
CO5	Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	3	3	3	3
CO2	3	2	2	2	2	3	2	3	3	3
CO3	2	3	3	3	2	2	2	3	3	3
CO4	3	2	2	3	3	3	2	3	3	3
CO5	2	2	2	2	2	2	2	1	1	1

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc.Honours -Botany-Major & Minor / II Semester End**  
**(W.E.F. 2024-25)**

**Course 3: Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)**  
**Credits -4**

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

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

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

1. Compile the general characteristics of algae and their significance in nature.
2. Compare and contrast the characteristics of different groups of algae.
3. Summarise the important features of fungi and their economic value.
4. Distinguish the characteristics of different groups of fungi.
5. Elaborate the features and significance of amphibians of plant kingdom
6. Explain the diversity among non-vascular plants.

**III. Syllabus of Theory:**

**Unit-1: Introduction to Algae** **8Hrs.**

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

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

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

**Unit-3: Introduction to Fungi** **8Hrs.**

1. General characteristics of fungi and Ainsworth (1973) classification.
2. Thallus organization and nutrition in fungi.

3. Reproduction in fungi (asexual and sexual); Heterothallism and parasexuality.
4. Ecological and economic importance of fungi.

**Unit-4: Biology of selected Fungi**

**10Hrs.**

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

**Unit-5: Biology of Bryophytes**

**9Hrs.**

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

**IV. Text Books:**

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

**V. Reference Books:**

1. Fritsch, F.E. (1945) The Structure & Reproduction of Algae (Vol. I & Vol. II) Cambridge University Press Cambridge, U.K.
2. Bold, H.C. & M. J. Wynne (1984) Introduction to the Algae, Prentice-Hall Inc., New Jersey
3. Robert Edward Lee (2008) Phycology. Cambridge University Press, New York
4. Van Den Hoek, C., D.G. Mann & H.M. Jahns (1996) Algae : An Introduction to Phycology. Cambridge University Press, New York.
5. Alexopoulos, C.J., C.W. Mims & M. Blackwell (2007) Introductory Mycology, Wiley & Sons, Inc., New York
6. Mehrotra, R.S. & K. R. Aneja (1990) An Introduction to Mycology. New Age International Publishers, New Delhi.

7. Kevin Kavanagh (2005) Fungi; Biology and Applications John Wiley& Sons, Ltd., West Sussex, England.
8. John Webster & R. W. S. Weber (2007) Introduction to Fungi, Cambridge University Press, New York.
9. Shaw, A.J.& B.Goffinet (2000) Bryophyte Biology .Cambridge University Press, New York.

#### **VI. Suggested activities and evaluation methods:**

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

**Evaluation method:** Evaluating the presentation or report summarizing findings.

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

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

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

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

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

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

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

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

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc.Honours -Botany-Major & Minor / II Semester End**  
**(W.E.F. 2024-25)**  
**Course 3: Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)**  
**PRACTICAL SYLLABUS**

**Credits -1**

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

1. Identify some algal and fungal species based on the structure of thalli and reproductive organs.
2. Decipher the lichens and Bryophytes based on morphological, anatomical and reproductive features.

**II. Laboratory/field exercises:**

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

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

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

**I Year B.Sc. HONURS BOTANY**

**Major & Minor**

**Practical Examinations at II Semester End**

**Model Paper**

**Course-3: Non-Vascular Plants ( Algae, Fungi, Lichens and Bryophytes )**

**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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1. Identify the given Alga material **A**. Make a temporary slide and justify the characters  
**10m**
2. Identify the given Fungal material **B**. Make a temporary slide and justify the characters  
**10m**
3. Identify the given Bryophyta material **C**. Make a temporary slide and justify the characters  
**10m**
4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**  
**D- Algae**  
**E-Fungi**  
**F-lichen**
5. Record + Viva voce **5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc., -Botany/ II Semester End (W.E.F. 2024-25)**

**Major & Minor**


**Course 3 :- Non- Vascular Plants ( Algae, Fungi, Lichens and Bryophytes)**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Sem ester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability/entrepreneurship)</b>
1	Botany	II	Non-Vascular Plants	Introduction to Algae	knowledge	Shall be shown by Microscope & Photographs	Skill
2	Botany	II	Non-Vascular Plants	Biology of selected Algae	knowledge	Shall be shown by Microscope & Photographs	Skill
3	Botany	II	Non-Vascular Plants	Introduction to Fungi	knowledge	Shall be shown by Microscope & Photographs	Skill
4	Botany	II	Non-Vascular Plants	Biology of Selected Fungi	knowledge	Shall be shown by Microscope & Photographs	Skill
5	Botany	II	Non-Vascular Plants	Biology of Bryophytes	knowledge	Shall be shown by Microscope & Photographs	Skill

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> I B.Sc. Honours (II Semester)			
Course3	<b>TITLE OF THE COURSE</b> <b>Non-Vascular Plants(Algae, Fungi, Lichens &amp; Bryophytes)</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

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

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Compile the general characteristics of algae and their significance in nature.
CO2	Compare and contrast the characteristics of different groups of algae.
CO3	Summarise the important features of fungi and their economic value.
CO4	Distinguish the characteristics of different groups of fungi.
CO5	Elaborate the features and significance of amphibians of plant kingdom

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	3	2	3	3	3
CO2	2	2	2	3	3	3	3	3	3	3
CO3	1	1	2	1	3	3	3	3	3	3
CO4	1	1	2	1	3	3	3	3	3	3
CO5	2	2	2	2	3	3	3	3	3	3

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc.Honours -Botany-Major / II Semester End (W.E.F. 2024-25)**

**Course 4: Origin of Life and Diversity of Microbes**

**Credits -3**

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

1. To get awareness on origin and evolution of life.
2. To understand the diversity of microbial organisms.
3. To get awareness on importance of microbes in nature and agriculture.

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

1. Illustrate diversity of viruses, multiplication and economic value.
2. Discuss the general characteristics, classification and economic importance of special groups of bacteria.
3. Explain the structure, nutrition, reproduction and significance of eubacteria.
4. Evaluate the interactions among soil microbes.
5. Compile the value and applications of microbes in agriculture.

**III. Syllabus of Theory:**

**Unit-1: Origin of life and Viruses**

**10 Hrs.**

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

**Unit-2: Special groups of Bacteria**

**7 Hrs.**

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

**Unit-3: Eubacteria**

**8 Hrs.**

1. Occurrence, distribution and cell structure of eubacteria.

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

**Unit-4: Soil microbes – interactions**

**10Hrs.**

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

**Unit-5: Microbes in agriculture**

**10 Hrs.**

1. Mass production, mode of applications, advantages and limitations of bacterial inoculants (*Rhizobium*, *Azotobacter*, *Azospirillum*, Cyanobacteria).
2. Role of Frankia and VAM in soil fertility.
3. Microbial biopesticides: mode of action, factors influencing, target pests; microbial herbicides.

**IV. Text Books:**

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

**V. Reference Books:**

1. Pelczar Jr., M.J., E.C.N. Chan & N. R. Krieg (2001) Microbiology, Tata McGraw- Hill Co, New Delhi
2. Prescott, L. Harley, J. and Klein, D. (2005) Microbiology, Tata McGraw –Hill Co. New Delhi.
3. Gyaneshwar, A.D., G.J. Parekh, and V.S. Reddy (2004) Agricultural Microbiology: Plant-Soil Interactions, Research Signpost, Kerala, India

4. Zaki A. Shuler and Zainul Abid (2014) Agricultural Microbiology: Principles and Applications, CRC Press, Boca Raton, Florida, USA

**VI. Suggested activities and evaluation methods:**

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

**Evaluation method:** Evaluating the report based on a rubric.

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

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

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

**Evaluation method:** Assessment based on accuracy and understanding.

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

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

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

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

**Course 4: Origin of Life and Diversity of Microbes**  
**PRACTICAL SYLLABUS**

Credits -1

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

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

**II. Laboratory/Field exercises:**

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

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I Year B.Sc. HONOURS BOTANY**  
**Practical Examinations at II Semester End**  
**Model Paper**  
**Course 4: Origin of Life and Diversity of Microbes**  
**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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1. Demonstrate the gram staining technique in bacteria **10m**
2. Identify the given material A (Cyanobacteria) and draw the diagram, justify the characters **10m**
3. Identify the given material B (Eubacteria) and draw the diagram, justify the characters **10m**
4. Identify the given Spotters and justify the characters **3 X 4 = 12m**  

**C-Laboratory equipment**

**D-virus (Gemini/TMV)**

**E-special type of bacteria ( Archaeobacteria / Actinomycetes )**
5. Record + Viva Voce **5 + 3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I B.Sc.Honours -Botany-Major / II Semester End (W.E.F. 2024-25)**


**Course 4: Origin of Life and Diversity of Microbes**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Sem ester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	II	Origin of Life and Diversity of Microbes	Origin of life and Viruses	Knowledge & Application	Lecture, case study, projects	Skill, Employability
2	Botany	II	Origin of Life and Diversity of Microbes	Special groups of Bacteria	Knowledge & Application	Lecture, by showing photographs	Skill, Employability
3	Botany	II	Origin of Life and Diversity of Microbes	Eubacteria	Knowledge & Application	Lecture, by showing photographs	Skill, Employability
4	Botany	II	Origin of Life and Diversity of Microbes	Soil microbes – interactions	Knowledge & Application	Lecture, case study, projects	Skill, Employability
5	Botany	II	Origin of Life and Diversity of Microbes	Microbes in agriculture	Knowledge, Application & Innovation	Lecture, case study, projects	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> I B.Sc. Honours (II Semester)			
Course4	<b>TITLE OF THE COURSE</b> <b>Origin of Life and Diversity of Microbes</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

1. To get awareness on origin and evolution of life.
2. To understand the diversity of microbial organisms.
3. To get awareness on importance of microbes in nature and agriculture.

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Illustrate diversity of viruses, multiplication and economic value.
CO2	Discuss the general characteristics, classification and economic importance of special groups of bacteria
CO3	Explain the structure, nutrition, reproduction and significance of eubacteria.
CO4	Evaluate the interactions among soil microbes.
CO5	Compile the value and applications of microbes in agriculture.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	3	3	3	3	3
CO2	2	3	2	3	3	3	3	3	3	3
CO3	2	3	2	3	3	3	2	3	3	3
CO4	2	2	3	2	3	3	3	3	3	3
CO5	3	2	3	2	3	3	3	3	3	3

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc Hons -Botany-III / III Semester (W.E.F. 2024-25)**  
**Major & Minor**

**Course 5 : Vascular Plants**

(Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Credits -3

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

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

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

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

**III. Syllabus of Theory:**

**Unit-1: Pteridophytes**

**10Hrs.**

1. General characteristics of Pteridophyta; Smith (1955) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Lycopsidea: *Lycopodium* and (b) Filicopsida: *Marsilea*
3. Stellar evolution in Pteridophytes; Heterospory and seed habit.
4. Ecological and economic importance of Pteridophytes.

**Unit-2: Gymnosperms**

**10Hrs.**

1. General characteristics of Gymnosperms; Sporne (1965) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Cycadopsida: *Cycas* and (b) Gnetopsida: *Gnetum*
3. Ecological and economic importance of Gymnosperms.

**Unit-3: Principles of Plant Taxonomy**

**10 Hrs.**

**PRGC BOT BOS 2024-25**

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

**Unit-4: Descriptive Plant Taxonomy**

**8 Hrs.**

Systematic description and economic importance of the following families:

1. Polypetalae: (a) Annonaceae (b) Curcubitaceae
2. Gamopetalae: (a) Asteraceae (b) Asclepiadaceae
3. Monochlamydae: (a) Amaranthaceae (b) Euphorbiaceae
4. Monocotyledonae: (a) Arecaceae (b) Poaceae

**Unit-5: Evidences for Plant systematics**

**7Hrs.**

1. Anatomy and embryology in relation to plant systematics.
2. Cytology and cytogenetics in relation to plant systematics.
3. Phytochemistry in relation to plant systematics.
4. Numerical taxonomy
5. Origin and evolution of angiosperms.

**IV. Text Books:**

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

## V. Reference Books:

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

## VI. Suggested activities and evaluation methods:

**Unit-1: Activity:** Making temporary slides/models/drawings of Pteridophytes in the syllabus.

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

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

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

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

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

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

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

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

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

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., -Botany-III / III Semester (W.E.F. 2024-25)**  
**Major & Minor**

**Course 5 : Vascular Plants**  
**(Pteridophytes, Gymnosperms and Angiosperm Taxonomy)**

Practical

02 hours /Week

Credits -1

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

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

**II Laboratory/field exercises:**

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

1. Pteridophyta: *Lycopodium* and *Marselia*
2. Gymnosperms: *Cycas* and *Gnetum*

II. Technical description of locally available plant species from the following angiosperm families:

- |                  |                  |               |                   |
|------------------|------------------|---------------|-------------------|
| 1. Annonaceae    | 2. Cucurbitaceae | 3. Asteraceae | 4. Asclepiadaceae |
| 5. Amaranthaceae | 6. Euphorbiaceae | 7. Arecaceae  | 8. Poaceae        |

III. Demonstration of herbarium techniques.

IV. Field trip to a local floristic area/forest (Submission of 30 number of Herbarium sheets of wild plants with the standard system are mandatory).

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

**II Year B.Sc. HONOURS BOTANY**

**Practical Examinations at III Semester End**

**Model Paper  
Major & Minor**

**Course 5 : Vascular Plants**

**(Pteridophytes, Gymnosperms and Angiosperm Taxonomy)**

**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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

**10m**

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

**10m**

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

**10m**

4. Identify the given Spotters and justify the characters.

**3 X 4 = 12 m**

**D- Pteridophytes**

**E-Gymnosperms**

**F-Taxonomy**

- 5.Record + Viva voce**

**5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major & Minor / III Semester (W.E.F. 2024-25)**

**Course 5 : Vascular Plants**


**(Pteridophytes, Gymnosperms and Angiosperm Taxonomy)**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Sem ester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	III	Vascular Plants	Pteridophytes	Knowledge & Application	Lecture, type study, field visit	Skill, Employability
2	Botany	III	Vascular Plants	Gymnosperms	Knowledge & Application	Lecture, type study, field visit	Skill, Employability
3	Botany	III	Vascular Plants	Principles of plant Taxonomy	Knowledge & Application	Lecture, type study, field visit	Skill, Employability
4	Botany	III	Vascular Plants	Descriptive taxonomy	Knowledge & Application	Lecture, type study, field visit	Skill, Employability
5	Botany	III	Vascular Plants	Evidences for Plant systematics	Knowledge, Application & Innovation	Lecture, type study, field visit	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> I B.Sc. Honours (IIISemester)			
Course5	<b>TITLE OF THE COURSE</b> <b>Vascular Plants</b> (Pteridophytes, Gymnosperms and Angiosperm Taxonomy)				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

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

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.
CO2	Illustrate the general characteristics of Gymnosperms along with their uses
CO3	Discuss about some Taxonomic aids and their applications in plant systematics.
CO4	Compare and contrast the vegetative and floral characteristics of some angiospermic families
CO5	Evaluate the economic value of plant species from the families under the study.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2	2	3	2	3
CO2	3	2	2	2	2	3	3	3	3	2
CO3	2	2	3	3	3	2	2	2	3	2
CO4	3	3	2	2	2	3	3	3	2	3
CO5	3	2	3	2	3	3	2	2	3	2

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., -Botany-III / III Semester (W.E.F. 2024-25)**

**Course 6: Plant Pathology and Plant Diseases**

**Credits -3**

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

1. To study various plant pathogens, their survival and dispersal mechanisms.
2. To understand the processes involved in infection and pathogenesis in plants.
3. To study the common diseases of some important field and horticultural crops.

**II. Learning Outcomes:**

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

**III. Syllabus of Theory:**

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

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

**Unit-2: Infection and pathogenesis in plants** **8 Hrs.**

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

**Unit-3: Plant disease management** **8 Hrs.**

1. Plant disease epidemiology; plant disease forecasting; remote sensing in plant pathology.
2. General principles of plant diseases management.

3. Regulatory methods, cultural methods; biological control and PGPR.
4. Physical methods, chemical methods; host plant resistance.
5. Integrated plant disease management (IDM) – Concept, advantages and importance.

**Unit-4: Diseases of field crops**

**12 Hrs.**

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

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

**Unit-5: Diseases of horticultural crops**

**9 Hrs.**

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

- a) Brinjal: Phomopsis blight and Little leaf
- b) Okra: Powdery mildew and Yellow vein mosaic
- c) Pomegranate: Alternaria fruit spot and Anthracnose
- d) Coconut: Bud rot and Basal stem rot

**IV. Text Books:**

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

**V. Reference Books:**

1. Agrios, G. N. (2005). Plant Pathology (5th ed.). Academic Press, San Diego, California.
2. Dehne, H. W. (Ed.). (2012). Plant Pathology: From Molecular Biology to Biological Control. Springer, Dordrecht, Netherlands.
3. Dicklow, M. B., & Beaudry, R. M. (Eds.). (2013). Plant Pathology Concepts and Laboratory Exercises (2nd ed.). CRC Press, Boca Raton, Florida.

4. Lucas, J. A. (1998). Plant Pathology and Plant Pathogens. Blackwell Science, Oxford, UK.
5. Lucas, J. A. (1998). Plant pathology and plant pathogens. Blackwell Science, Oxford, UK.
6. Schumann, G. L., & D'Arcy, C. J. (2010). Essential Plant Pathology (2nd ed.). APS Press, St. Paul, Minnesota.
7. Schumann, G. L., and C. D'Arcy (2010). Essential plant pathology. APS Press, St. Paul, MN.
8. Singh, R. P., and U. S. Singh (2020). Plant diseases: Identification, management and challenges. Springer, Singapore.

#### **VI. Suggested activities and evaluation methods:**

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

**Evaluation method:** Field reports, presentations and visual documentation based on a rubric.

**Unit-2: Activity:** Case studies on plant infections and factors contributing to disease development.

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

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

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

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

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

**Unit-5: Activity:** Microscopic observations and making drawings of diseased samples.

**Evaluation method:** Formative assessment of presentation of findings through visuals/ drawings.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc., -Botany-III / III Semester (W.E.F. 2024-25)**

**Course 6: Plant Pathology and Plant Diseases**

**Credits -1**

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

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

**II. Laboratory/field exercises:**

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

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

**Course 6: Plant Pathology and Plant Diseases**  
**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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1. Isolation and Identification of plant pathogenic fungi (A). **10m**
2. Isolation and Identification of plant pathogenic bacteria(B). **10m**
3. Identification of phanerogamic plant parasites (C). **10m**
4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**
  - D- plant pathological laboratory and field equipment.
  - E- plant pathogenic nematodes.
  - F- selected diseases of field crops/ Horticulture crops
5. Record + Viva voce **5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2024-25)**


**Course 6: Plant Pathology and Plant Diseases**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Sem ester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	III	Plant Pathology and Plant Diseases	Plant pathogens, survival and dispersal	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
2	Botany	III	Plant Pathology and Plant Diseases	Infection and pathogenesis in plants	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
3	Botany	III	Plant Pathology and Plant Diseases	Plant disease management	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
4	Botany	III	Plant Pathology and Plant Diseases	Diseases of field crops	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
5	Botany	III	Plant Pathology and Plant Diseases	Diseases of horticultural crops	Knowledge, Application & Innovation	Lecture, Case study, field visit	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> II B.Sc. Honours (III Semester)			
Course6	<b>TITLE OF THE COURSE</b> <b>Plant Pathology and Plant Diseases</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

1. To study various plant pathogens, their survival and dispersal mechanisms.
2. To understand the processes involved in infection and pathogenesis in plants.
3. To study the common diseases of some important field and horticultural crops.

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Identify major groups of plant pathogens and classify plant diseases.
CO2	Explain various stages in infection, plant pathogenesis and responsible factors.
CO3	Elaborate the preventive and control measures for plant diseases.
CO4	Discuss about some diseases of field crops and their management.
CO5	Discuss about some diseases of horticultural crops and their management.

## CO-PO Mapping:

(1:Slight[Low];  
Correlation)

2:Moderate[Medium];

3:Substantial[High],    '-':No

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2	2	3	2	3
CO2	3	2	2	2	2	3	3	3	3	2
CO3	2	2	3	3	3	2	2	2	3	2
CO4	3	3	2	2	2	3	3	3	2	3
CO5	3	2	3	2	3	3	2	2	3	2

**Course :- 7 Plant Breeding**

**Credits -3**

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

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

**II. Learning Outcomes:**

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

**III. Syllabus of Theory:**

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

1. Definition, aim, objectives and scope of plant breeding; concepts in plant breeding: genetic variation, heritability, and selection.
2. Advantages and disadvantages of asexual and sexual reproduction; apomixis: definition, types and significance.
3. A brief account of self and cross-pollination, their genetic consequences and significance; classification of crop plants based on mode of pollination and mode of reproduction.

**Unit-2: Contrivances for cross pollination** **7 Hrs.**

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

**Unit-3: Breeding methods in plants** **9 Hrs.**

1. Plant introduction – types, objectives, plant introduction agencies in India, procedure, merits and demerits; germplasm collections, genetic erosion, gene sanctuaries.

2. Selection – natural and artificial selection – basic principles of selection.
3. Self-pollinated crops: pure line selection method – procedure, advantages and disadvantages, achievements.
4. Vegetatively propagated crops: Clonal selection - procedure, advantages and disadvantages, achievements.

**Unit-4: Breeding methods in cross-pollinated plants**

**12 Hrs.**

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

**Unit-5: Modern methods in plant breeding**

**9 Hrs.**

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

#### **IV. Text Books:**

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

#### **V. Reference Books:**

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

#### **VI. Suggested activities and evaluation methods:**

**Unit-1: Activity:** Written assessment on reproduction and pollination mechanisms in plants.

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

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

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

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

**Evaluation method:** Active participation and learning skills on production of hybrid plants.

**Unit-5: Activity:** Case studies of modern applications of molecular techniques in crop improvement.

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

**Course 7: Plant Breeding**

**Credits -1**

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

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

**II. Laboratory/field exercises:**

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

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

**Course 7: Plant Breeding**

**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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1. Pollen viability test.(A). **15m**
2. Observation on pollen germination.(B). **07m**
3. Identify the given Spotters and justify the characters. **4 X 5 = 20m**
- C- self and a cross pollinated plant species
- D- selfing and crossing techniques.
- E- emasculation technique
- F- pollination mechanism
- 5.Record + Viva voce** **5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2024-25)**


**Course 7: Plant Breeding**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	III	Plant Breeding	Basic concepts of plant breeding	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
2	Botany	III	Plant Breeding	Contrivances for cross pollination	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
3	Botany	III	Plant Breeding	Breeding methods in plants	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
4	Botany	III	Plant Breeding	Breeding methods in cross-pollinated plants	Knowledge & Application	Lecture, Case study, field visit	Skill, Employability
5	Botany	III	Plant Breeding	Modern methods in plant breeding	Knowledge, Application & Innovation	Lecture, Case study, field visit	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> II B.Sc. Honours (III Semester)			
Course7	<b>TITLE OF THE COURSE</b> <b>Plant Breeding</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

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

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Compare and contrast the methods of reproduction and also pollination mechanisms.
CO2	Recommend the best possible breeding method for a crop species.
CO3	Propose the steps for production of hybrid varieties of crop plants.
CO4	Apply molecular techniques to develop a tailored plant variety.
CO5	Discuss about modern methods in Plant Breeding

## CO-PO Mapping:

(1:Slight[Low];  
Correlation)

2:Moderate[Medium];

3:Substantial[High],    '-':No

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	3	2	2	3
CO2	2	2	3	2	3	2	3	3	3	2
CO3	3	2	3	3	2	2	2	3	2	2
CO4	3	2	3	2	2	2	2	3	3	3
CO5	2	2	2	2	3	3	3	3	2	2

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2024-25)**

**Course 8: Plant Biotechnology**

**Credits -3**

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

1. To acquire knowledge of sterilization techniques used in plant tissue culture.
2. To learn about various types of plant tissue culture practices.
3. To know the applications of plant biotechnology in production of novel plants.

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

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

**III. Syllabus of Theory:**

**UNIT-1: Basic techniques in plant tissue culture**

**10 Hrs.**

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

**UNIT-2: Organ and haploid culture techniques**

**8 Hrs.**

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

characterization and applications.

**UNIT-3: Cell and protoplast cultures**

**12 Hrs.**

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

**UNIT-4: Transgenic plants.**

**8 Hrs.**

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

**UNIT-5: Advances in plant biotechnology**

**7 Hrs.**

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

**IV. Text Books:**

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

4. Narayanaswamy, S (1994) Plant Cell and Tissue Culture, Tata –Mc Graw Hill Publishing Co., Ltd., New Delhi.

#### **V. Reference Books:**

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

#### **VI. Suggested activities and evaluation methods:**

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

**Evaluation method:** Assessment of skill in preparation of media in an effective manner.

**Unit-2: Activity:** Group discussion on various tissue culture practices.

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

**Unit-3: Activity:** Designing a bioreactor system for mass cultivation of plant cells.

**Evaluation method:** Awarding grade based on skills performed in designing a prototype bioreactor.

**Unit-4: Activity:** Collection of scientific literature on various transgenic plants developed.

**Evaluation method:** Assess credibility and relevance of literature collected, analysis and conclusions made.

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

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

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2024-25)**

**Course 8: Plant Biotechnology**

**Credits -1**

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

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

**II. Laboratory/field exercises:**

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

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

**Course 8: Plant Biotechnology**

( 2024-25)

**Time: 2 Hrs.**

**Max. Marks: 50**

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- |  |                    |
|--|--------------------|
| 1. (A) Preparation of culture media.                       | <b>15m</b>         |
| 2. (B) Demonstration of anther and pollen culture.         | <b>12m</b>         |
| 3. Identify the given Spotters and justify the characters. | <b>3 X 5 = 15m</b> |
| C- Equipments used in tissue culture laboratory            |                    |
| D- Organ culture   |                    |
| E- Transgenic plants                                       |                    |
| <br>   |                    |
| 5. Record + Viva voce                                      | <b>5+3 = 8m</b>    |

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / III Semester (W.E.F. 2024-25)**


**Course 8 : Plant Biotechnology**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	III	Plant Biotechnology	Basic techniques in plant tissue culture	Knowledge & Application	Lecture, practical knowledge	Skill, Employability
2	Botany	III	Plant Biotechnology	Organ and haploid culture techniques	Knowledge & Application	Lecture, practical knowledge	Skill, Employability
3	Botany	III	Plant Biotechnology	Cell and protoplast cultures	Knowledge & Application	Lecture, practical knowledge	Skill, Employability
4	Botany	III	Plant Biotechnology	Transgenic plants	Knowledge & Application	Lecture, Case study	Skill, Employability
5	Botany	III	Plant Biotechnology	Advances in plant biotechnology	Knowledge, Application & Innovation	Lecture, Case study, field visit	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> II B.Sc. Honours (IIISemester)			
Course8	<b>TITLE OF THE COURSE</b> <b>Plant Biotechnology</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

1. To acquire knowledge of sterilization techniques used in plant tissue culture.
2. To learn about various types of plant tissue culture practices.
3. To know the applications of plant biotechnology in production of novel plants.

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Explain the scientific techniques and tools used in plant tissue culture laboratories
CO2	Appraise the applications of plant tissue culture in agriculture and horticulture sectors.
CO3	Acquire skills related to various aspects in plant tissue culture.
CO4	Evaluate the role of transgenic plants in solving certain plant related beneficiary issues.
CO5	Justify the role of plant biotechnology in bioenergy and phytoremediation.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	2	2	2	2	1
CO2	3	2	2	1	2	3	3	3	2	3
CO3	2	3	2	2	3	3	2	2	2	3
CO4	3	3	3	2	2	2	2	2	2	3
CO5	2	3	2	2	3	3	3	3	3	2

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**

**Course 9: Anatomy and Embryology of Angiosperms**

**Credits -3**

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

1. To know about various types of tissues in plants and their organization.
2. To obtain awareness on anomalous secondary growth in plants and economic value of woods.
3. To acquire knowledge on development of male and female gametophytes in plants.
4. To probe into embryogenesis in angiosperms.

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

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

**III. Syllabus of Theory:**

**Unit – 1: Tissues in plants**

**8 Hrs.**

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

**Unit-2: Anomalous growth in plants**

**10Hrs.**

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

**Unit-3: Anther and pollen****10Hrs.**

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

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

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

**Unit-5: Embryogeny and seeds****7Hrs.**

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

**IV. Text Books:**

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

**V. Reference Books:**

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

Approach, Wiley, USA

4. Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London
5. Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
8. Johri, B.M. (2011) Embryology of Angiosperms. Springer-Verlag, Berlin

#### **VI. Suggested activities and evaluation methods:**

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

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

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

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

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

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

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

**Evaluation method:** Assessment of the best performing group.

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

**Evaluation method:** Evaluating the best drawings and comparative report.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**

**Course 9: Anatomy and Embryology of Angiosperms**

**Credits -1**

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

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

**Laboratory/field exercises:**

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

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

**Course 9: Anatomy and Embryology of Angiosperms**  
**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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1. (A) Anamalous Secondary growth in Boerhavaia **12m**
2. (B) Dissection and observation of Endosperm haustoria in *Crotalaria* **10m**
- 3.(C). Study of pollen germination and pollen viability **8m**
3. Identify the given Spotters and justify the characters. **3 X 4= 12m**
- C- Tissue organization in shoot apices
- D- dicot / monocot embryos
- E- Types of ovules
- 5.Record + Viva voce** **5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**


**Course 9: Anatomy and Embryology of Angiosperms**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	IV	Anatomy and Embryology of Angiosperms	Tissues in plants	Knowledge & Application	Lecture, Observation of anatomical structures	Skill, Employability
2	Botany	IV	Anatomy and Embryology of Angiosperms	Anomalous growth in plants	Knowledge & Application	Lecture, Observation of anatomical structures	Skill, Employability
3	Botany	IV	Anatomy and Embryology of Angiosperms	Anther and pollen	Knowledge & Application	Lecture, Observation of anatomical structures	Skill, Employability
4	Botany	IV	Anatomy and Embryology of Angiosperms	Ovules, fertilization and endosperm	Knowledge & Application	Lecture, Observation of anatomical structures	Skill, Employability
5	Botany	IV	Anatomy and Embryology of Angiosperms	Embryogeny and seeds	Knowledge, Application & Innovation	Lecture, Observation of anatomical structures	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> II B.Sc. Honours (IV Semester)			
Course9	<b>TITLE OF THE COURSE</b> <b>Anatomy and Embryology of Angiosperms</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives

1. To know about various types of tissues in plants and their organization.
2. To obtain awareness on anomalous secondary growth in plants and economic value of woods.
3. To acquire knowledge on development of male and female gametophytes in plants.
4. To probe into embryogenesis in angiosperms.

### Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Categorize various tissues and evaluate their role in plants.
CO2	Explain anomalous secondary growth in some plants and justify the value of timber plants.
CO3	Summarize the events in micro-sporogenesis and development of male gametophyte.
CO4	Discuss the events in mega-sporogenesis and development of female gametophyte.
CO5	Propose the incidents in embryogenesis of an angiospermic plant species.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	3	3	2	2	3
CO2	3	2	2	3	3	2	2	2	3	3
CO3	2	3	2	3	2	2	2	3	3	3
CO4	2	3	2	2	2	3	2	2	2	3
CO5	3	2	3	2	2	3	2	3	3	2

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**

**Course 10: Plant Ecology, Biodiversity and Phytogeography**

**Credits -3**

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

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

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

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

**III. Syllabus of Theory:**

**Unit-1: Basic concepts in ecology**

**10 Hrs.**

1. Ecology: definition, branches and significance; relation with other sciences.
2. Structure and functions of ecosystems- abiotic and biotic components; flow of energy.
3. Cycling of materials: water, carbon, nitrogen and phosphorus; trophic pyramids, food chains and food webs.
4. Plants and environment: Climatic (light and temperature) and edaphic.
5. Interactions among plants; interactions between plants and animals.

**Unit-2: Population and community ecology**

**10Hrs.**

1. Population ecology: definition, characteristics -natality, mortality, growth curves, ecotypes, ecads.
2. Community ecology: characteristics -frequency, density, cover, life forms, competition, biological spectrum.

3. Ecological succession: Hydrosere and Xerosere.
4. Concepts of productivity: GPP, NPP and Community Respiration
5. Secondary production, P/R ratio and Ecosystems.

**Unit-3: Climate change-impacts**

**8Hrs.**

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

**Unit-4: Concepts of Biodiversity**

**10Hrs**

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

**Unit-5: Phytogeography**

**7 Hrs.**

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

**IV. Text Books:**

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

Jodhpur

6. Mani, M.S (1974) Ecology & Biogeography of India Dr. W. Junk Publishers, The Hague

**V. Reference Books:**

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

**VI. Suggested activities and evaluation methods:**

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

**Evaluation method:** Valuation of record of attendance and report submission with conclusions

**Unit- 2: Activity:** Case studies on population and community ecologies and making a comprehensive report

**Evaluation method:** Assessing the report and awarding grade

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

**Evaluation method:** Assessing the report and awarding grade.

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

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

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

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

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**

**Course 10: Plant Ecology, Biodiversity and Phytogeography**

**Credits -1**

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

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

**II. Laboratory/field exercises:**

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

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

**Course 10: Plant Ecology, Biodiversity and Phytogeography**  
**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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1. 1. (A) Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance. **12m**
2. (B) Study of morphological and anatomical adaptations of given hydrophytes **10m**
- 3.(C). Mapping of phytogeographical regions of the globe and India. **5m**
3. Identify the given Spotters and justify the characters. **3X 5= 15m**
  - D- Ecology instruments
  - E- Biodiversity hotspots in india(Map)
  - F- xerophytes
- 5.Record + Viva voce **5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**


**Course 10: Plant Ecology, Biodiversity and Phytogeography**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	IV	Plant Ecology, Biodiversity and Phytogeography	Basic concepts in ecology	Knowledge & Application	Lecture, Case Study, Field Visits	Skill, Employability
2	Botany	IV	Plant Ecology, Biodiversity and Phytogeography	Population and community ecology	Knowledge & Application	Lecture, Case Study, Field Visits	Skill, Employability
3	Botany	IV	Plant Ecology, Biodiversity and Phytogeography	Climate change-impacts	Knowledge & Application	Lecture, Case Study, Field Visits	Skill, Employability
4	Botany	IV	Plant Ecology, Biodiversity and Phytogeography	Concepts of Biodiversity	Knowledge & Application	Lecture, Case Study, Field Visits	Skill, Employability
5	Botany	IV	Plant Ecology, Biodiversity and Phytogeography	Phytogeography	Knowledge, Application & Innovation	Lecture, Case Study, Field Visits	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> II B.Sc. Honours (IV Semester)			
Course ID	<b>TITLE OF THE COURSE</b> <b>Plant Ecology, Biodiversity and Phytogeography</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives:

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

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Explain the interactions among the biotic and abiotic components in an ecosystem.
CO2	Summarize the characteristics of a population and a community.
CO3	Anticipate the environmental problems arising due to climate change.
CO4	Assess the value of biodiversity and choose appropriate conservation strategy.
CO5	Make a survey on the distribution of various plant groups in a specified geographical area.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	2	3	1	2	3
CO2	3	3	3	2	3	3	2	2	2	2
CO3	2	2	2	3	2	2	3	3	3	3
CO4	3	3	3	2	3	3	2	2	2	2
CO5	2	2	2	3	3	3	3	3	3	2

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**

**Course 11: Plant Resources and Utilization**

**Credits -3**

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

1. To know different plants domesticated by humans and utility of their products.
2. To gain knowledge on commercial and timber products obtained from plants.
3. To know the facts on economic value of plants products in relation to human welfare.

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

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

**III. Syllabus of Theory:**

**UNIT-1: Food plants**

**10 Hrs.**

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

**UNIT-2: Other economic plant products**

**8 Hrs.**

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

**UNIT-3: Commercial plant products**

**8 Hrs.**

1. A general account and economic potential of spices and condiments.

2. Plant sources and economic importance of flavouring products, beverages, fumitories and masticatories and narcotics.

3. Utilization of some important ornamentals, flowering plants and orchids.

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

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

2. Active compounds in medicinal plants and their pharmacological effects.

3. Essential oils and their uses; aromatic plants in perfumery and cosmetics.

4. Phytochemicals and their potential health benefits.

**UNIT-5: Timber products and energy crops** **9 Hrs.**

1. Important timber yielding plants of India; wood as a construction and manufacturing material.

2. Other uses of wood products, such as paper and fuel.

3. Energy crops, biofuels and bioplastics.

4. Bamboos, *Eucalyptus*, *Casuarina* - generation of paper industry raw material.

**IV. Textbooks:**

1. S. K. Jain and R. A. Jain, (2015) Handbook of Plant Resources, Springer, New York.

2. H. Panda and A. K. Padhi, (2017) Medicinal Plants and Their Utilization, Springer, Singapore.

3. G.E. Wickens (1998) Economic Botany: Principles and Practices, Chapman & Hall, London.

4. S.L. Kochhar (1990) The Economic Botany of the Tropics, Macmillan, London.

**V. Reference Books:**

1. K. V. Peter, (2004) Handbook of Herbs and Spices, CRC Press, Boca Raton.

2. J. E. Simon, J. A. Duke, and E. A. L. Bobilya, (1990) Handbook of Edible Weeds, CRC Press, Boca Raton.

3. J. Smartt and N. Haq, (2016) Handbook of Industrial Crops, Springer, New York.

4. P. N. Ravindran, (2017) The Encyclopaedia of Herbs and Spices, CABI, Wallingford.

5. Beryl B. Simpson (2010) Economic Botany: Plants in Our World, Academic Press, London.

6. Michael J. Balick and Paul Alan Cox (1996) *Plants, People, and Culture: The Science of Ethnobotany*, Scientific American Library, New York.
7. Ben-Erik van Wyk (2016) *Food Plants of the World: An Illustrated Guide*, Timber Press, Portland.
8. Jo Homan (2012) *Plants That Changed History*, Chartwell Books, New York.
9. Gary J. Martin (2004) *Ethnobotany: A Methods Manual*, Earthscan Publications, London.

#### **VI. Suggested activities and evaluation methods:**

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

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

**Unit-2: Activity:** Group discussion on various plant products and their source plants.

**Evaluation method:** Assess the logical flow and coherence of the group's discussion based on a grading scale.

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

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

**Unit-4: Activity:** A case study report on phytochemicals used in human health care.

**Evaluation method:** Examine the depth and coherence of the discussion and interpretation based on a rubric.

**Unit-5: Activity:** A field trip to timber depots and silviculture plantations in their locality.

**Evaluation method:** Evaluate the level of student engagement and active participation during the trip based on a grading scale.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**

**Course 11: Plant Resources and Utilization**

**Credits -1**

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

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

**II. Laboratory/field exercises:**

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

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

**Course 11: Plant Resources and Utilization**  
**( 2024-25)**

**Time: 2 Hrs.**

**Max. Marks: 50**

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

**10m**

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

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

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

**D-** dye yielding plants

**E-** resin yielding plants

**E-** tannin yielding plants

**F-** biofuel yielding plants

**5.Record + Viva voce**

**5+3 = 8m**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II B.Sc.Honours -Botany-Major / IV Semester (W.E.F. 2024-25)**


**Course 11: Plant Resources and Utilization**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	IV	Plant Resources and Utilization	Food plants	Knowledge & Application	Lecture, Field Visits	Skill, Employability
2	Botany	IV	Plant Resources and Utilization	Other economic plant products	Knowledge & Application	Lecture, Field Visits	Skill, Employability
3	Botany	IV	Plant Resources and Utilization	Commercial plant products	Knowledge & Application	Lecture, Field Visits	Skill, Employability
4	Botany	IV	Plant Resources and Utilization	Medicinal and aromatic plant products	Knowledge & Application	Lecture, Field Visits	Skill, Employability
5	Botany	IV	Plant Resources and Utilization	Timber products and energy crops	Knowledge, Application & Innovation	Lecture, Field Visits	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> II B.Sc. Honours (IV Semester)			
Course II	<b>TITLE OF THE COURSE</b> <b>Plant Resources and Utilization</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives:

1. To know different plants domesticated by humans and utility of their products.
2. To gain knowledge on commercial and timber products obtained from plants.
3. To know the facts on economic value of plants products in relation to human welfare.

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Explain the significance of plants in human nutrition.
CO2	List out different plant products used by human beings.
CO3	Evaluate the commercial plant products and their utilization
CO4	Discuss the uses of medicinal and aromatic plants for human health care.
CO5	Appraise the importance of timber and non-timber products for value added products.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	2	2	3	3	2
CO2	2	2	3	2	2	3	3	2	2	3
CO3	3	2	3	3	3	2	2	3	3	2
CO4	2	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	2	2	2	2	2	3

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc -Botany / V Semester (W.E.F. 2024-25)**

**Course 6B: Vegetable Crops – Cultivation Practices**

(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

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

1. Identify different vegetable plants and realize their value in human nutrition.
2. Analyse the types of soils to cultivate vegetable crops.
3. Demonstrate skills on agronomic practices for cultivation of vegetable crops.
4. Acquire knowledge on water, weed and disease managements in vegetable farming.
5. Comprehend aspects related to harvesting and storage of produce.

**II. Syllabus:** (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05) (*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

**Unit – 1: Introduction to Olericulture** (10h)

1. Vegetables and Olericulture: Definitions, nutritive value of vegetables and economic significance of vegetable farming.
2. Classification of vegetable crops (Botanical, based on climatic zones and economic parts used).
3. Types of vegetable gardens (kitchen gardening, terrace gardening, market gardening and truck gardening); implements used in vegetable gardening; vegetable forcing – a brief concept.

**Unit – 2: Cultivation of leafy vegetables** (10h)

1. Leafy vegetables: Definition and a brief account of locally cultivated crops.
2. Study of the following leafy vegetable crops: (a) *Amaranthus* (b) Palak (c) *Hibiscus cannabinus* (d) Fenugreek: systematic position, nutritive value, origin, area, production, improved varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield, storage, disease and pest control and seed production.

**Unit – 3: Cultivation of fruity vegetables** (10h)

1. Fruity vegetables: Definition and a brief account of locally cultivated crops.
2. Study of the fruity vegetable crops: (a) Okra (b) Tomato (c) Chillies (d) Brinjal: systematic position, nutritive value, origin, area, production, improved varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield- storage, disease and pest control and seed production

**Unit – 4: Cultivation of peas and beans** (10h)

1. A brief account of locally cultivated peas and beans.

2. Study of the following crops: (a) *Dolichos* (b) Cluster bean (c) French bean: Systematic position, nutritive value, origin, area, production, improved Varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield, storage, disease and pest control and seed production.

**Unit – 5: Cultivation of root and tuber crops** (10h)

1. A brief account of locally cultivated root and tuber crops.
2. Study of the following crops: (a) Carrot (b) Radish (c) Sweet potato (d) Potato: Systematic position, family, nutritive value, origin, area, production, improved varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield, storage, disease and pest control and seed production.

**III. References:**

1. Bose T K et al. (2003) Vegetable crops, Naya Udhog Publishers, Kolkata.
2. Singh D K (2007) Modern vegetable varieties and production, IBN Publisher Technologies, International Book Distributing Co, Lucknow.
3. Premnath, Sundari Velayudhan and D P Sing (1987) Vegetables for the tropical region, ICAR, New Delhi
4. Shanmugavelu, K. G. 1989. Production Technology of Vegetable Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Rana MK. 2008. Scientific Cultivation of Vegetables. Kalyani Publ., New Delhi
6. Rubatzky VE and Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall, London.
7. Web resources suggested by the teacher concerned and the college librarian including reading material.

**Course 6B: Vegetable Crops – Cultivation Practices**  
**Practical syllabus**

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

1. List out, identify and handle different garden implements.
2. Identify the important vegetable crops grown in their locality.
3. Demonstrate various skills in cultivation of vegetable crops.
4. Identify pests, diseases and their remedies that are specific to a vegetable crop.

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

1. Identification of seeds of important local vegetable plants and preparation of herbarium.
2. Identification of local vegetable crops and handling of garden tools.
3. Analysis of garden soil for ratios of physical characteristics by sieve separation.
4. Determination of chemical characters of garden soil (pH, EC, Organic Carbon, SAR).
5. Planning and layout of a vegetable crop farm.
6. Preparation of nursery bed (raised, sunken and flat beds) and sowing of seeds.
7. Transplanting and care of vegetable seedlings.
8. Intercultural operations in vegetable plots.
9. Estimation of Total Soluble Solids (TSS) by Refractometer in a fruit and a leafy vegetable.
10. Estimation of Vitamin - C in a fruit and a leafy vegetable by DCIP method.
11. Identification of pests and disease-causing organisms on any two vegetable plants.
12. Seed extraction in tomato and brinjal.

## VI. Lab References:

1. Akhilesh Sharma (Ed.), 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
2. Biswajit Saha and Shri Dharampal Singh, 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
3. Saini RS, K.D. Sharma, O.P, Dhankhar and R.A. Kaushik (Eds.). 2001. Laboratory Manual of Analytical Techniques in Horticulture. Agrobios, Jodhpur
4. Ranganna S. 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata-McGraw Hill, New Delhi
5. Web sources suggested by the teacher concerned.

## VII. Co-Curricular Activities:

### a) **Mandatory:** (*Lab/ field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by the teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of vegetable plants identification, vegetable gardening, agronomic practices, water, weed and disease management; harvesting and storage of produce.
2. **For Student:** Students shall (individually) visit a horticulture university/ research station or vegetable crop farm in their locality, observe different vegetable crops/ varieties of a vegetable crop, intercultural operations, pests and diseases, harvesting and storage etc., write their observations and submit to the teacher a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

### b) **Suggested Co-Curricular Activities:**

1. Training of students by related industrial experts or farmers.
2. Assignments (including technical assignments like tools in vegetable gardening and their handling, agronomic practices, modern irrigation methods, organic farming practices etc.)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on cultivation practices for vegetable crops.
5. Collection of material/figures/photos related to different vegetable crop species, writing and organizing them in a systematic way in a file.
6. Visits to horticulture universities, research organizations, private vegetable farming units etc.
7. Invited lectures and presentations on related topics by field/industrial experts

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc. -Botany / V Semester (W.E.F. 2024-25)**

**Model Question Paper Pattern for Practical Examination**

Semester – V/ Botany Skill Enhancement Course

**Vegetable Crops – Cultivation Practices**

Max. Time: 3 Hrs.

Max. Marks: 50

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- |   |            |
|---|------------|
| 1. Demonstration of nursery bed making/transplanting of seedlings 'A'   | 8          |
| 2. Determination of physical or chemical characters of a given soil sample / Preparation of slide and identification of pest/disease-causing organism in plant part given 'B' | 10         |
| 3. Estimation of Total Soluble Solids/Vitamin-C in a given plant sample 'C'   | 12         |
| 4. Scientific observation and data analysis   | 4 x 3 = 12 |
| D. Identification of a garden tool  |            |
| E. Identification of seed/specimen of a vegetable crop species  |            |
| F. Identification of a weed/irrigation method   |            |
| G. Identification of a pest/disease causing organism  |            |
| 5. Record + Viva-voce   | 5+3 = 8    |

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc. -Botany / V Semester (W.E.F. 2024-25)**


**Vegetable Crops – Cultivation Practices**

**Mapping as per Blooms Taxonomy**

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<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	V	Vegetable crops : Cultivation Practices	Introduction to Olericulture	Knowledge & Application	Lecture, Field Visits	Skill, Employability
2	Botany	V	Vegetable crops : Cultivation Practices	Cultivation of leafy vegetables	Knowledge & Application	Lecture, Field Visits	Skill, Employability
3	Botany	V	Vegetable crops : Cultivation Practices	Cultivation of fruity vegetables	Knowledge & Application	Lecture, Field Visits	Skill, Employability
4	Botany	V	Vegetable crops : Cultivation Practices	Cultivation of peas and beans	Knowledge & Application	Lecture, Field Visits	Skill, Employability
5	Botany	V	Vegetable crops : Cultivation Practices	Cultivation of root and tuber crops	Knowledge, Application & Innovation	Lecture, Field Visits	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester III B.Sc. (V Semester)</b>			
Course 6B	<b>TITLE OF THE COURSE Vegetable Crops – Cultivation Practices</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives:

1. Understanding Plant Physiology and Growth Requirements
2. Soil Health and Fertility Management
3. Integrated Pest Management (IPM)
4. Sustainable Cultivation Practices
5. Post-Harvest Handling and Quality Control

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Identify different vegetable plants and realize their value in human nutrition.
CO2	Analyse the types of soils to cultivate vegetable crops.
CO3	Demonstrate skills on agronomic practices for cultivation of vegetable crops.
CO4	Acquire knowledge on water, weed and disease managements in vegetable farming.
CO5	Comprehend aspects related to harvesting and storage of produce.

## CO-PO Mapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	2	3	3	3	2	2	2
CO2	3	2	2	3	3	2	2	3	3	3
CO3	2	3	3	2	2	3	3	2	2	2
CO4	3	2	3	3	2	3	2	3	3	3
CO5	2	3	2	2	3	3	2	2	2	2

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc. -Botany / V Semester (W.E.F. 2024-25)**

**Course 7B: Vegetable Crops – Post Harvest Practices**  
(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

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

1. Understand various practices for vegetable produce from harvesting to marketing.
2. Demonstrate skills on storage, processing and preservation of vegetables.
3. Summarize causes for spoilage of vegetables before and during storage and methods to prevent and control them.
4. Make use of preservation methods to reduce the loss of vegetable produce.
5. Explain about value added products, packaging and marketing of vegetables.

**II. Syllabus:** (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)  
(Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours)

**Unit – 1: Introduction to Post Harvest Practices (10h)**

1. Post-harvest technology: Definition; importance, scope and future status of post-harvest management of vegetables.
2. Study of maturity standards of vegetables; harvest techniques of vegetables, methods stages, signs of harvesting; harvesting and its relationship with quality, sorting and grading.
3. Careful handling of harvested vegetables; pre-harvest and post-harvest factors responsible for ripening.

**Unit – 2: Methods of storage (10h)**

1. Climacteric and non-climacteric types of vegetables.
2. Methods of storage to prolong shelf life of harvested vegetables; on-farm storage, evaporatively cooled stores, ventilated storage, pit storage etc.
3. Refrigerated storage, refrigeration cycle, controlled and modified atmosphere, hypobaric storage.

**Unit – 3: Processing of vegetables (10h)**

1. Causes for spoilage of vegetables and control measures during storage; post-harvest disease and pest management.
2. Techniques to prevent deterioration; vegetable processing equipment; minimal processing of vegetables.
3. Safe chemicals and microbial limits; application of growth regulators for quality assurance; grading.

**Unit -4: Preservation and value-addition (10h)**

1. Importance and scope of vegetable preservation in India; principles underlying general methods of preservation.
2. Methods of preservation; food additives and food colours.

3. Fried products, process of frying; dried vegetables; sauces and chutneys, pickles and salted vegetables; by-product and waste utilization.

### **Unit – 5: Marketing**

(10h)

1. Packing line operations, packaging of vegetables and their products; transportation; codex norms for export of perishables.
2. Demand supply analysis of important vegetables; market potential of various vegetables products.
3. Important marketing agencies and institutions; importance of cooperative marketing.

### **III. References:**

1. Salunkhe DK and Kadam SS. (Ed.). 1998. Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker, New York.
2. Arthey D and Dennis C. 1996. Vegetable Processing. Blackie/Springer-Verlag, New York
3. Verma LR and Joshi VK. 2000. Post-harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management. Indus Publishing Company, New Delhi
4. Srivastava RP and Kumar S. 2003. Fruit and Vegetable Preservation: Principles and Practices. International Book Distribution Company, Lucknow.
5. Giridharilal GS, Siddappa and Tandon GL. 1986. Preservation of Fruits and Vegetables. ICAR, New Delhi.
6. Web resources suggested by the teacher concerned and the college librarian including reading material.

### **Course 7B: Vegetable Crops – Post harvest Practices – Practical syllabus**

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

1. Identify stages of maturity in vegetable crops.
2. Handle material for storage of vegetables.
3. Identify physical and biological causes for spoilage of vegetables.
4. Make some value-added products of vegetables.

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

1. Maturity selection and harvest, harvesting practices.
2. List and cost of equipment, utensils, and additives required for small scale processing industry.
3. Estimation of total carbohydrates (Anthrone method) in a stored vegetable and un- stored vegetable.
4. Estimation of protein (Lowry method) in a stored vegetable and un-stored vegetable.
5. Identification of packaging materials, containers for packaging.
6. Preparation of pickle from a vegetable.
7. Preparation of tomato sauce, ketchup and chutney.

**VI. Lab References:**

1. Swati Barche, Reena Nair and P. K. Jain, 2016. A Practical Manual on Post Harvest Value Addition and Processing of Horticulture Crops. Agrobios (India), Jodhpur
2. Antonio L. Acedo Jr., Md. Atiqur Rahman, Borarin Buntong and Durga Mani Gautam, 2016. Vegetable Postharvest Training Manual, AVRDC - The World Vegetable Center, Taiwan
3. Akhilesh Sharma (Ed.), 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
4. Biswajit Saha and Shri Dharampal Singh, 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
5. Web sources suggested by the teacher concerned.

**VII. Co-Curricular Activities:**

**a) Mandatory:** (*Lab/ field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of harvesting indices of vegetables, storage methods, tools and techniques for processing, causes for spoilage and methods to control, preservation methods, marketing chain and in making value added products.
2. **For Student:** Students shall (individually) visit any one of the places like horticulture university/ research station; vegetable storage units in public and private sector; vegetable processing industries in their locality and observe harvesting practices, storage methods, processing and preservation; grading, value added products and marketing. Write their observations and submit to the teacher

a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

**b). Suggested Co-Curricular Activities:**

1. Training of students by related industrial experts or farmers.
2. Assignments (including technical assignments like tools and techniques for storage, processing and preservation, causes for spoilage and methods to avoid losses, value added products of some vegetables, packaging and marketing etc.)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on cultivation practices for vegetable crops.
5. Collection of material/figures/photos related to harvesting, storage, processing and preservation of vegetable crop produce, writing and organizing them in a systematic way in a file.
6. Visits to horticulture universities, research organizations; storage, processing industries in public or private sector; industries making value added products of vegetables etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc. -Botany / V Semester (W.E.F. 2024-25)**

**Model Question Paper Pattern for Practical Examination**

Semester – V/ Botany Skill Enhancement Course

**Vegetable Crops – Post Harvest Practices**

Max. Time: 3 Hrs.

Max. Marks: 50

- 
- |  |            |
|--|------------|
| 1. Preparation of pickle from a vegetable. 'A'                           | 8          |
| 2. Maturity selection and harvest, harvesting practices.                 | 10         |
| 3. Estimation of carbohydrates/protein content in a vegetable sample 'C' | 12         |
| 4. Scientific observation and data analysis                              | 4 x 3 = 12 |
| D. Identification of harvesting stage                                    |            |
| E. Identification of equipment for processing                            |            |
| F. Identification of PGR/chemical used for PHT of vegetables.            |            |
| G. Identification of a packaging material/value added product.           |            |
| 5. Record + Viva-voce  | 5+3 = 8    |


**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III B.Sc -Botany / V Semester (W.E.F. 2024-25)**

**Vegetable Crops – Post Harvest Practices**

**Mapping as per Blooms Taxonomy**

<b>S. N O</b>	<b>Subject</b>	<b>Semester</b>	<b>Title of the course (Paper)</b>	<b>Topic</b>	<b>Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)</b>	<b>Experiential learning component</b>	<b>Scope (skill/ employability /entrepreneurship)</b>
1	Botany	V	Vegetable crops : Post Harvest Practices	Introduction to Post Harvest Practices	Knowledge & Application	Lecture, Field Visits, Hands on Practices	Skill, Employability
2	Botany	V	Vegetable crops : Post Harvest Practices	Methods of storage	Knowledge & Application	Lecture, Field Visits, Hands on Practices	Skill, Employability
3	Botany	V	Vegetable crops : Post Harvest Practices	Processing of vegetables	Knowledge & Application	Lecture, Field Visits, Hands on Practices	Skill, Employability
4	Botany	V	Vegetable crops : Post Harvest Practices	Preservation and value-addition	Knowledge & Application	Lecture, Field Visits, Hands on Practices	Skill, Employability
5	Botany	V	Vegetable crops : Post Harvest Practices	Marketing	Knowledge, Application & Innovation	Lecture, Field Visits, Hands on Practices	Skill, Employability

## CO-PO Mapping

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester</b> III B.Sc. (V Semester)			
Course No	<b>TITLE OF THE COURSE</b> <b>Vegetable Crops – Post Harvest Practices</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		3	1	2	3

### Course Objectives:

1. Understanding Post-Harvest Physiology.
2. Post-Harvest Handling Techniques.
3. Storage and Preservation Methods.
4. Quality Control and Assurance.
5. Post-Harvest Technologies and Innovations.

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand various practices for vegetable produce from harvesting to marketing.
CO2	Demonstrate skills on storage, processing and preservation of vegetables.
CO3	Summarize causes for spoilage of vegetables before and during storage and methods to prevent and control them.
CO4	Make use of preservation methods to reduce the loss of vegetable produce.
CO5	Explain about value added products, packaging and marketing of vegetables.

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	3	3	2	3	3	2	2	3
CO2	2	3	3	2	2	3	2	2	3	3
CO3	3	3	2	2	3	2	3	2	3	2
CO4	2	3	2	3	2	2	2	3	3	2
CO5	3	2	2	3	2	3	3	2	2	3

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**I Honours -Botany-Major / I Semester (W.E.F. 2024-25)**

**PRINCIPLES OF BIOLOGICAL SCIENCES**  
**MULTI DISCIPLINARY COURSE IN I SEMESTER**  
**SYLLABUS**

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**Credits : 2**

**2 hrs/week**

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

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

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

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

### **UNIT-I Diversity of Life**

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

### **UNIT-II Biomolecules and metabolism**

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

### **UNIT-III Principles of Biology**

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

anaemia.

- 3.2 Evolution: Geological time scale for evolution of plants and vertebrates, Origin and evolution of plants and man
- 3.3 Common Human Diseases: causing organism, prevention and treatment- malaria, dengue, AIDS, cancer, corona.
- 3.4 Common Plant Diseases: causing organism, prevention and treatment- Black spot, Leaf spots, Powdery mildew, Blight, Canker.
- 3.5 Biotechnology: Tools and process of recombinant DNA technology, Applications of biotechnology in agriculture, food industry, medicine and transgenic animals.

### **Text Books**

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

### **Reference Books**

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

**Model question paper for theory examination at the end of I Semester Multidisciplinary  
Course**

**Principles of Biological Science**

**Max. Time : 2 Hrs.**

**Max. Marks: 50**

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Max. Marks: 50 Time: 1 1/2 hrs (90 Minutes)

**Section -A**

(Total: 4x5=20 Marks)

(Answer any **four questions**. Each answer carries **5 marks**)

(Total 8 questions. At least 1 question should be given from each Unit)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**Section- B**

(Total: 3x10 = 30 Marks)

(Answer any **three questions**. Each answer carries **10 marks**)

(Total five questions. At least 1 question should be given from each Unit)

- 1.
- 2.
- 3.
- 4.
- 5.

**Note:** Questions may be set in such a way to test the outcomes instead of recalling of information.

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**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA  
CERTIFICATE COURSE FOR BOTANY**

**TITLE : ORGANIC FARMING**

**2024-25**

**For I, II & III Years**

**Total Hours : 45 Hours**

**Credits : 2**

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Department of Botany will be going to conduct 45 days certificate course in the academic year 2024-25. 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 on going

**2) Course :** ORGANIC FARMING

**3) Medium :** English

**4) Course duration :** 45 hrs.

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

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

**7) Mode of instructins :** off line and online

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

**9) Instructors :** Dr M.Krishna Rao

Dr.Ch.John Samuel.

**10) Fee :** Exam fee Rs 200/

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA  
(W.E.F. 2024-25)**

**PRGC BOTANY BOS 24-25**

## CERTIFICATE COURSE

Total hours of instructions and practicals - 45

### ORGANIC FARMING

#### SYLLABUS

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#### UNIT:-1

9hrs

Organic Farming : Introduction, History and Importance ; Methods, Advantages and Limitations ; Need of Organic Farming in Present Context and future prospects. Organic Ecosystem and their concept : Nutrient Cycling, Eutrophication, Biological Magnification.

#### UNIT:-2

9hrs

Composition of soil - soil texture and types, Soil structure, soil Profile, Humus and Soil PH ; Role of Soil in Organic Farming ; Soil Factors affecting Plant growth : Light, Heat, Water, Humidity, PH and Nutrition. C:N Ratio of Good fertile soil.

#### UNIT:-3

9hrs

Organic Farm Management : Land Preparation – Tools & Techniques ; Preparation of Seed Bed, Manuring, Sowing, Watering and Raising of seedlings ; Crop management : Pest control ( Cultural, Biological, Mechanical methods) ; Integrated pest management.

#### UNIT:-4

9hrs

Crop rotation : Needs and Benefits ; Harvesting and post harvesting management ; Certification and Marketing : Inspection, Certification and Labelling procedure ; Marketing and Export.

#### HANDS ON TRAINING & PRACTICALS

9hrs

Field visit ( with your own expenses)

1 Day

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

The **Board of Studies in BOTANY** for the academic year 2024-2025 held in 30-04-2024 in Dept. of Botany.

**AGENDA:**

The board of studies of a department in the college shall

1. Adapting APSICHE syllabus for all Semesters
2. Introducing new papers in V semester for honours
3. Adapting 50- External evaluation and 50- Internal evaluation for II, III, IV & V Semesters, 200 for VI<sup>th</sup> Semesters for complete Internship
4. Conduct of Semester End Practical examinations for I, II, & III Years
5. Approval of conversion of teaching method for some practical oriented topics through audio & video visuals
6. Approval of student online courses including faculty for the year 2024-25.
7. Approval of I, II, & III Years I, II, III, IV & V semesters syllabus with theory will be finalized by following APSICHE.
8. Approval of NPTEL courses to all Botany students
9. Approval to introduce Organic Farming as a Certificate course for I, II, & III Years
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 APSCHE for the Academic year 2024-25.
2. Resolved I, II, III Years- I, II, III, IV & V Semesters syllabus with theory will be finalized by following APSCHE guidelines in coming one or two months.
3. Resolved to adopt 50 External, 50 Internal evaluations for all I, II & III Years students , 200 for 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%.

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

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

**Dr. M. Krishna Rao**  
Lecturer in-charge  
Dept. of botany  
PRGC(A), KAKINADA  
MOBILE: 9440134559  
E-Mail: Mortha9@gmail.com

**Dr. J. SUNITHA,**  
University Nominee  
Principal GDC Kovvuru  
Mobile: 9441050910  
E-Mail: drjsuneetha@grjy.ac.in

*online*

**Dr. A. Srinivas Rao**  
Lecturer incharge  
Department of Botany  
Government Arts College,  
Rajahmundry  
Mobile: 9985076306  
Email.Id:- drannabattulasrao@gmail.com

*online*

**Mrs. P. Sara**  
Lecturer incharge Botany  
GDC, Ramachandrapuram  
Mobile: 7386379223

*P. Sara*  
*30/4/24*

**Smt P. SWATHI**  
Assistant Director  
Dept. of Agriculture  
Pithapuram  
Mobile: 9848350962  
E-Mail: [swathi3002@yahoo.com](mailto:swathi3002@yahoo.com)

*30/4/24*

**Dr. D R SALOMI SUNEETHA**  
Professor & Head  
Dr. YSR Horticulture University  
Venkatramannagudem-534101

*online*

**Faculty members:**

- 1. Dr. Ch. JOHN SAMUEL**  
Lecturer in Botany  
PRGC(A), Kakinada
- 2. M.V.V.S. Ganga Bhavani**  
Guest faculty in Botany
- 3. N. Deepika**  
Guest faculty in Botany
- 4. M.S.S. Parvathi**  
Guest faculty in Botany
- 5. G. Mispa Kumari**  
Guest faculty in Botany
- 6. V. David Samson**  
Guest faculty in Botany

*M. Ganga Bhavani.*

*N. D. — pile*

*M. S. S. P. — the*

*G. Mispa Kumari*

*V. David Samson.*

**B.STUDENT MEMBERS**

1. M. Angel Tejaswi  
II B.Sc MBC
2. B.A.N.V.B.Savithri  
I B.Sc Hons Botany
- 3.R.Rajya Lakshmi  
I B.Sc Hons Botany



B.A.N.V.D. Savithri.

R. Rajyalaxmi

**C. Parent Member**

1. M. Rajendra Babu  
Ph.no:-798101936

  
30/4/24