

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**

PRGC BOT BOS 2024-25

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

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.**

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

V. Reference Books:

1. Smith, G.M. (1971) 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

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

S. N O	Subject	Sem ester	Title of the course (Paper)	Topic	Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)	Experiential learning component	Scope (skill/ employability /entrepreneur ship)
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

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester I B.Sc. Honours (IIISemester)			
Course5	TITLE OF THE COURSE Vascular Plants (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

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

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

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

S. N O	Subject	Sem ester	Title of the course (Paper)	Topic	Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)	Experiential learning component	Scope (skill/ employability /entrepreneurship)
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

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester II B.Sc. Honours (IIISemester)			
Course6	TITLE OF THE COURSE Plant Pathology and Plant Diseases				
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

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

Course :- 7 Plant Breeding

Credits -3

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

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

II. Learning Outcomes:

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

III. Syllabus of Theory:

Unit-1: Basic concepts of plant breeding

8 Hrs.

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

Unit-2: Contrivances for cross pollination

7 Hrs.

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

Unit-3: Breeding methods in plants

9 Hrs.

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

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

Unit-4: Breeding methods in cross-pollinated plants

12 Hrs.

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

Unit-5: Modern methods in plant breeding

9 Hrs.

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

IV. Text Books:

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

V. Reference Books:

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

VI. Suggested activities and evaluation methods:

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

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

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

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

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

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

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

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

Course 7: Plant Breeding

Credits -1

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

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

II. Laboratory/field exercises:

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

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

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

S. N O	Subject	Semester	Title of the course (Paper)	Topic	Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)	Experiential learning component	Scope (skill/ employability /entrepreneurship)
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

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester II B.Sc. Honours (IIISemester)			
Course7	TITLE OF THE COURSE Plant Breeding				
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

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 presentation, 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

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

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

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

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

C- Equipments used in tissue culture laboratory

D- Organ culture

E- Transgenic plants

5.Record + Viva voce

5+3 = 8m

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

S. N O	Subject	Semes ter	Title of the course (Paper)	Topic	Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)	Experiential learning component	Scope (skill/ employability /entrepreneu rship)
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 biotechnolog y	Knowledge, Application & Innovation	Lecture, Case study, field visit	Skill, Employability

CO-PO Mapping

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester II B.Sc. Honours (III Semester)			
Course8	TITLE OF THE COURSE Plant Biotechnology				
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