SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

DEPARTMENT OF BOTANY

Course Code				**23BOMAL231**			
Title of the Course				**VASCULAR PLANTS (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:	**2024-25**			**Semester:**		**III**	
Course Category:	**MAJOR**			**Course Relates to:**	**GLOBAL**		
Year of Revision:				**Percentage:**	**NA**		
Type of the Course:				**SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**KNOWLEDGE OF VASCULAR PLANTS AT +2 LEVEL**			

Course Description:

A comparative study of pteridophytes, gymnosperms and angiosperms, integrating from function and ecology. This course is designed to introduce students to the major lineages of vascular plants, including the ferns, gymnosperms and flowering plants. Students will be introduces to basic plant structure (anatomy and morphology) and diversity, as well as topics in plant evolution. An understanding of vascular plants is essential for global citizens with interests in biodiversity, ecology, agriculture, forestry, medicine and biochemistry. This course will provide one with a basic and comprehensive understanding of Vascular Plants (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms). Enable the student with depth of topics and helps them to gain an appreciation in the special groups of Pteridophytes and Gymnosperms. On the other hand, importance of understanding Taxonomy of the flowering plant provides an extensive knowledge to the student.

Course Aims and Objectives:

S.NO	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 angiosperm families along with their economic value.
4	To study the significance of other branches of botany in relation to Plant taxonomy.
5	To evaluate the economic value of Plant species from the families under the study.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.	**K2**	**4**	**2**
CO2	Illustrate the general characteristics of Gymnosperms along with their uses.	**K2**	**4**	**1**
CO3	Discuss about some Taxonomic aids and their applications in Plant systematics.	**K6**	**4**	**1**
CO4	Compare and contrast the vegetative and floral characteristics of some angiospermic families.	**K4**	**4**	**1**

CO5	Defend the utility of evidences from different branches of botany in solving the taxonomic lineages of some species.	K5	4	1

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1				**3**					**1**
CO2				**3**				**1**	
CO3				**3**				**1**	
CO4				**2**				**1**	
CO5				**1**				**1**	

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1: [Pteridophytes] (12Hrs)

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

Examples/Applications/Case Studies:

Case Study 1- True Alternation of Generations.

Case Study 2- Pteridophytes as Primary Colonizers.

Exercises/Projects:

Project 1- Poster Making of Life Cycle of Pteridophytes

Project 2- Model of Types of Steles in Pteridophytes

Specific Resources:

https://www.youtube.com/watch?v=FTZQIeL80hc&pp=ygUNcHRlcmlkb3BoeXRlcw%3D%3D

Unit – 2: [Gymnosperms] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study 1- Analyzing the distribution of seed size

Case Study 2- Functionally pleiotropic with defense

Exercises/Projects:

Project 1- Collection of photographs of gymnosperm plants

Project 2- Wood elements in locally available gymnosperms

Specific Resources:

https://www.youtube.com/watch?v=zZ6XPDDeVwk&pp=ygULZ3ltbm9zcGVybXM%3D

Unit – 3: [Principles of Plant Taxonomy] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study 1- Identification, Classification and Description of Plants

Case Study 2- Interrelationship between plants

Exercises/Projects:

Project 1- A brief report on present status of plant taxonomy

Project 2- List of systems of plant taxonomy

Specific Resources:

https://www.youtube.com/watch?v=5kuuNHCGkTo&pp=ygUccHJpbmNpcGxlcyBvZiBwbGFudCB0YXhvbm9teQ%3D%3D

Unit – 4: [Descriptive Plant Taxonomy] (12Hrs)

Systematic description and economic importance of the following families:

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

Examples/Applications/Case Studies:

Case Study 1- Poster making of comparative study of above said families

Case Study 2- Identification of 10 members of different families by each student

Exercises/Projects:

Project 1- Collection of inflorescence of above said families

Project 2- Preparation of herbarium of above said families

Specific Resources:

https://www.youtube.com/watch?v=CVaPfKr101c&pp=ygUOcGxhbnQgZmFtaWxpZXM%3D

Unit – 5: [Evidences for Plant Systematics] (12Hrs)

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

Examples/Applications/Case Studies:

Case Study 1- Assignment on evolution of angiosperms

Case Study 2- Assignment on plant taxonomy and its contribution

Exercises/Projects:

Project 1- Identifying the diversity among different plant species

Project 2- Understanding the numerical taxonomy by applying numerical units to the available plants

Specific Resources:

https://www.youtube.com/watch?v=z5STVo2jRrI&pp=ygUfZXZpZGVuY2VzIGZvciBwbGFudCBzeXN0ZW1hdGljcw%3D%3D

TEXT BOOKS:

1. Acharya, B.C., (2019) Archchegoniates, Kalyani Publishers, New Delhi
2. Pandey, B.P. (2013) College Botany, Volumes-I&II, S. Chand Publishing, New Delhi

REFERENCES:

1. Sharma,O.P.(2012) Pteridophyta. Tata McGraw-Hill, New Delhi
2. Bhatnagar, S.P. &AlokMoitra (1996) Gymnosperms. New Age International, New Delhi.

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Course Code				**23BOMAP231**			
Title of the Course				**VASCULAR PLANTS (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:		**2024-25**		**Semester:**		**III**	
Course Category:		**Major**		**Course Relates to:**		**Global**	
Year of Revision:				**Percentage:**		**NA**	
Type of the Course:				**Skill development**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**KNOWLEDGE OF VASCULAR PLANTS AT +2 LEVEL**			

Course Description:

An overview of the course content and objectives.

A comparative study of pteridophytes, gymnosperms and angiosperms, integrating form, function and ecology. This course is designed to introduce students to the major lineages of vascular plants, including the ferns, gymnosperms and flowering plants. Students will be introduced to basic plant structure (anatomy and morphology) and diversity, as well as topics in plant evolution. An understanding of vascular plants is essential for global citizens with interests in biodiversity, ecology, agriculture, forestry, medicine and biochemistry.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	Compare and contrast the general structure and function of roots, stems, and leaves as well as identify modifications of these organs for specialized functions.
2	Explain photosynthesis as a process and how it has been modified in plants adapted for different environments.
3	Discuss the potential impacts of global climate change and predict how plants will respond.
4	Identify the main innovations that occurred in vascular plant evolution and indicate them on a phylogenetic tree.
5	Name the main groups of extant (living today) vascular plants and distinguish them based on their structure and reproduction.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	1. Distinguish the Pteridophytes and Gymnosperms based on their morphological characters.	**K2**	**6**	**1**
CO2	2. Distinguish the Pteridophytes and Gymnosperms based on their anatomical characters.	**K2**	**6**	**1**
CO3	3. Distinguish the Pteridophytes and Gymnosperms based on their reproductive structures.	**K2**	**6**	**1**
CO4	4. Make systematic classification of plant species using vegetative and floral characters.	**K2**	**6**	**1**
CO5	5. Identify angiosperm plant species and make herbarium specimens.	**K2**	**6**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1						**3**		**1**	
CO2						**3**		**1**	
CO3						**3**		**1**	
CO4						**3**		**1**	
CO5						**3**		**1**	

Course Structure

This lab list covers the key areas of a Vascular Plants course, providing hands-on practice with microscopic observations.

Unit 1: [Pteridophytes] (6Hrs)

Lab 1: 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*

- **Dataset** (web link) / **Experiment**: https://youtu.be/VR5soZ1Qg-E
- **Tasks:** Individual preparation and mounting of temporary slide.

Unit 2: [Gymnosperms] (6Hrs)

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

1. Gymnosperms: *Cycas and Gnetum*

- **Dataset** (web link) / **Experiment**: https://youtu.be/mGiqGFfy7eA
- **Tasks:** Individual preparation and mounting of temporary slide.

Unit 3: [Principles of Plant Taxonomy] (6Hrs)

Lab 1: Demonstartion of herbarium techniques

- **Dataset** (web link) / **Experiment**: https://youtu.be/HaaX5WzlAiI
- **Tasks:** Prepartion of herbarium sheets.

Unit 4: [Descriptive Plant Taxonomy] (6Hrs)

Lab 1: 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

- **Dataset** (web link) / **Experiment**:

https://youtu.be/JG5M5qocNN8
https://youtu.be/nSwMbO-yIsU
https://youtu.be/MbzekBV5tgg
https://youtu.be/zVkXQr7aU6A

- **Tasks:** Identification of angiosperm plant families

Unit 5: [Evidences for Plant Systematics] (6Hrs)

Lab 1: Field trip to a local floristic area/forest (submission of 30 number of herbarium sheets of wild plants with the standard system are mandatory).

- **Dataset** (web link) / **Experiment**: https://youtu.be/ADoiU_YTprk
- **Tasks:** Identification of different types of herbs.

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SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**23BOMAL231 VASCULAR PLANTS (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)**
Offered to:	**B.Sc Hons Botany**
Category:	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks). Answer All questions. Each question carries 4 Marks.

Q1 (a) Describe the Lycopodium cone. K1
OR
(b) Describe the Marselia petiole. K1

Q2 (a) Explain Cycas corolloid roots. K2
OR
(b) Explain economic importance of Gymnosperms. K2

Q3 (a) Explain Herbarium technique. K2
OR
(b) Explain APG-IV classification. K2

Q4 (a) Discuss the economic uses of Annonaceae. K2
OR
(b) Explain the head inflorescence. K2

Q5 (a) Describe the numerical taxonomy. K1
OR
(b) Define and describe alkaloids & flavonoids. K1

Section B: Long Answer Questions (50 Marks) Answer All questions. Each question carries 10 Marks.

Q6 (a) Explain the general characters of Pteridophyta and mention smith classification.K2
OR
(b) Explain the Heterspory seed habit. K2

Q7 (a) Discuss the general characters of gymnosperms and add a note on alternation of generations. K2
OR
(b) Extend a note on life history of Gnetum. K2

Q8 (a) Define and describe ICBN and its rules. K2
OR
(b) Describe the Bentham and Hooker system of classification. K2

Q9 (a) Describe the characters of Family Cucurbitaceae in detail. K1
OR
(b) Describe the Vegetative and Floral Characters of Family Euphorbiaceae. K1

Q10 (a) Describe an account on cytogenetics. K2
OR
(b) Describe the embryology in relation to systematics K2

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SEMESTER -END LAB EXAMINATION

Course Code: 23BOMAP231 **Offered to: B.Sc Hons Botany**

Semester: III **Max.Marks: 50 (CIA+SEE) Max. Time: 3 Hrs**

I. Answer the following. **Max. Marks: 30 Marks**

Q1. Take T.S. of the material '**A**' (Pteridophyta), make a temporary slide and justify the identification with apt points. 8M

Q2. Take T.S. of the material '**B**' (Gymnosperms), make a temporary slide and justify the identification with apt points. 8M

Q3. Describe the vegetative and floral characters of material '**C**' (Taxonomy of Angiosperms) and derive its systematic position. 8M

Q4. Identify the botanical name and family of collected herbarium '**D**' & '**E**'. 3M

Q5. Identify and write a comment on '**F**' (Pteridophyte) & '**G**' (Gymnosperm). 3M

II Viva **3 Marks**

III Record **2 Marks**

(B) CONTINUOUS ASSESMENT(Internal) **15 MARKS**

TOTAL : (A)+(B) = **50MARKS**

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Course Code				**23BOMAL232**			
Title of the Course				**PLANT PATHOLOGY AND PLANT DISEASES**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:		**2024-25**		**Semester:**			**III**
Course Category:		**MAJOR**		**Course Relates to:**		**GLOBAL**	
Year of Revision:				**Percentage:**		**NA**	
Type of the Course:				**SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**KNOWLEDGE OF PLANT DISEASES AT +2 LEVEL**			

Course Description:

The course introduces the basic concepts of plant disease biology and control, covering disorders caused by fungi, viruses, bacteria, and nematodes, as well as the role of environmental factors (including temperature, moisture, and others) in contributing to the development of epidemics. Upon completion, students will be able to find, interpret, and use scientific literature on plant diseases and discuss a range of control strategies suitable for both traditional and organic growers. Plant diseases are major constraints in the production of food and other crops. The effective control of plant diseases requires understanding the biology of plant diseases and the factors conducive to their development. This course introduces students to basic concepts regarding the biology of plant pathogens, the role of environmental conditions in promoting development of plant diseases, and the development of effective approaches to disease control. At the end of the course, students will be able to find, interpret, and apply scientific information on plant diseases to make management decisions.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To study various plant pathogens, their survival and dispersal mechanisms.
2	To understand the process involved in infection and pathogenesis in plants.
3	To study the common diseases of some important field crops.
4	To study the common disease of some horticultural crops.
5	To understand the management practices of plant diseases.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Identify major groups of plant pathogens and classify plant diseases.	**K1**	**5**	**1**
CO2	Explain various stages in infection, plant pathogenesis and responsible factors.	**K2**	**5**	**1**
CO3	Elaborate the preventive and control measures for plant diseases.	**K2**	**5**	**1**
CO4	Discuss about some diseases of field crops and their management.	**K2**	**5**	**1**
CO5	Discuss about some diseases of horticultural crops and their management.	**K2**	**5**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1					**3**			**1**	
CO2					**3**			**1**	
CO3					**3**			**1**	
CO4					**3**			**1**	
CO5					**3**			**1**	

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1: [Plant pathogens, survival and dispersal] (12Hrs)

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. Dispersal of plant pathogens – active and passive processes.

Examples/Applications/Case Studies:

Case Study 1- Identifying the survival life a pathogen in and around

Case Study 2- Identifying the dispersal of pathogen in and around

Exercises/Projects:

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.

Specific Resources:

https://youtu.be/W8fBGL3p08c

Unit – 2: [Infection and pathogenesis in plants] (12Hrs)

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. Defense mechanisms in plants against pathogens.

Examples/Applications/Case Studies:

Case Study 1- Making report on fairly distinct infection causing stages

Case Study 2- Poster making on epiphytotic factors

Exercises/Projects:

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.

Specific Resources:

https://www.youtube.com/watch?v=xi4Q0AvJha4&pp=ygUkaW5mZWN0aW9uIGFuZCBwYXRob2dlbmVzaXMgaW4gcGxhbnRz

Unit – 3: [Plant disease management] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study 1- Assignment on impairment of the normal state of a plant
Case Study 2- Assignment on making a goal to reduce the economic and aesthetic damage caused by plant diseases

Exercises/Projects:

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.

Specific Resources:

https://www.youtube.com/watch?v=rwiKxaCrHGM&pp=ygUYcGxhbnQgZGlzZWFzZSBtYW5hZ2VtZW50

Unit – 4: [Diseases of field crops] (12Hrs)

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

Examples/Applications/Case Studies:

Case Study 1- Crop disease impact on fields yield
Case Study 2- Self –study of disease management in selected crops

Exercises/Projects:

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

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

Specific Resources:

https://www.youtube.com/watch?v=8FKMzQAeLzs&pp=ygUeZGlzZWFzZXMgb2YgaG9ydGljdWx0dXJlIGNyb3Bz

Unit – 5: [Diseases of horticultural crops] (12Hrs)

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

Examples/Applications/Case Studies:

Case Study 1- Sustainable farming practices to avoid diseases of the above said crops
Case Study 2- Increased productivity and quality

Exercises/Projects:

Activity: Microscopic observations and making drawings of diseased samples.

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

Specific Resources:

https://www.youtube.com/watch?v=8FKMzQAeLzs&pp=ygUeZGlzZWFzZXMgb2YgaG9ydGljdWx0dXJlIGNyb3Bz

TEXT BOOKS:

1. R.S. Mehrotra (2008) Plant Pathology, Tata McGraw-Hill Education, New Delhi
2. P.D. Sharma (2011) Fundamentals of Plant Pathology, Tata McGraw-Hill Education, New Delhi

REFERENCES:

1. Singh, R. P., and U. S. Singh (2020). Plant diseases: Identification, management and challenges. Springer, Singapore.

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(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

Course Code				**23BOMAP232**			
Title of the Course				**PLANT PATHOLOGY AND PLANT DISEASES**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:		**2024-25**		**Semester:**			**III**
Course Category:		**MAJOR**		**Course Relates to:**		**GLOBAL**	
Year of Revision:				**Percentage:**		**NA**	
Type of the Course:				**Skill development**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**KNOWLEDGE OF PLANT DISEASES AT +2 LEVEL**			

Course Description:

An overview of the course content and objectives.

This course is an introduction to the science of plant pathology. Topics include causal agents of plant diseases, symptoms and diagnosis, modes of infection and spread, effects of the environment on disease development, and methods of disease control. The course will also cover plant's defense mechanisms, and conventional and novel control strategies. Students have the responsibility in learning the fundamentals in plant pathology through the use of the required textbook, lecture notes, and lab materials. The students are particularly required to understand the concepts, and theories and some memorization (botanical and pathogen scientific names, etc.).

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To understand the principles of host-pathogen interactions.
2	To understand how diseases occur in plants.
3	To learn e defense mechanisms plants have against plant pathogens.
4	To identify how other microorganisms and humans have been able to manipulate the host-pathogen interaction.
5	Knowledge to reduce and manage diseases.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Identify the knowledge, skills, attitudes, and personal attributes expected of them to successfully complete their program of studies	**K2**	**6**	**1**
CO2	Facilitate to develop of learning goals and objectives in their courses and programs, in prioritizing and focusing the learning experiences, and in the selection of appropriate assessment tools.	**K6**	**6**	**1**
CO3	Handle equipment and instruments in plant pathology laboratory.	**K3**	**6**	**1**
CO4	Isolate plant pathogenic microbes**.**	**K2**	**6**	**1**
CO5	Identify the plant diseases based of histopathological observations.	**K2**	**6**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1						**3**		**1**	
CO2						**3**		**1**	
CO3						**3**		**1**	
CO4						**3**		**1**	
CO5						**3**		**1**	

Course Structure

This lab list covers the key areas of plant pathology and plant diseases course, providing hands-on practice with handling equipment and instruments used in plant pathology laboratory.

Unit 1: [Plant pathogens, survival and dispersal] (6Hrs)

Lab 1: Familiarity with general plant pathological laboratory and field equipment.

- **Dataset** (web link) / **Experiment**: https://youtu.be/F8w-0AsdhtY
- **Tasks: Identification of different types of lab and field equipment**

Unit 2: [Infection and pathogenesis in plants] (6Hrs)

Lab 1: Infection process of plant diseases (Pre penetration, penetration, Post penetration).

- **Dataset** (web link) / **Experiment**: https://youtu.be/MML5c6H5kpk
- **Tasks:** Identification of phases of penetration in plants.

Unit 3: [Plant disease management] (6Hrs)

Lab 1: Plant disease management practices.

(1) Physical

(2) Chemical

- **Dataset** (web link) / **Experiment**: https://youtu.be/lgZHqXCgz5E
- **Tasks:** Applying management practices in daily life.

Unit 4: [Diseases of field crops] (6Hrs)

Lab 1: Field Crops

(1) Blast of Rice: symptoms, disease cycle, management practices.

(2) Phytophthora blight: symptoms, disease cycle, management practices.

(3) Ticca leaf disease: symptoms, disease cycle, management practices.

- **Dataset** (web link) / **Experiment**: https://youtu.be/7_7gu9lG5TY
- **Tasks:** Identification of disease spots on plant parts.

Unit 5: [Diseases of horticultural crops] (6Hrs)

Lab 1: Horticultural Crops

(1) Little leaf of brinjal: symptoms, disease cycle, management practices.

(2) Yellow mosaic of okra: symptoms, disease cycle, management practices.

(3) Anthracnose: symptoms, disease cycle, management practices.

- **Dataset** (web link) / **Experiment**: https://youtu.be/QHZ1Z8T3oUM
- **Tasks:** Identification of disease spots on plant parts.

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**23BOMAL232 PLANT PATHOLOGY AND PLANT DISEASES**
Offered to:	**B.Sc Hons Botany**
Category:	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

Q1 (a) Describe the scope and objectives of plant pathology. K1
OR
(b) Describe the survival of plant pathology. K1

Q2 (a) Define and describe the active and passive invaders. K1
OR
(b) Describe role of toxins in plant pathology. K1

Q3 (a) Explain the human cultural practices on development of epidemics. K2
OR
(b) Explain the quarantine. K2

Q4 (a) Discuss about downy Mildew in Bajra. K2
OR
(b) Explain wilt and sterility Mosaic in Pigeon pea. K2

Q5 (a) Discuss yellow vein Mosaic of Okra. K2
OR
(b) Explain anthracnose in Punica granatum. K2

Section B: Long Answer Questions (50 Marks)

Answer All questions. Each question carries 10 Marks.

Q6 (a) Explain dispersal of plant pathogens through Passive process. K2
OR
(b) Discuss the most important Plant pathogenic organisms with examples of diseases caused by them. K2

Q7 (a) What is infection? Explain the role of different factors for success of infection process. K2
OR
(b) Explain the defence mechanisms in plants against pathogens. K2

Q8 (a) Describe remote sensing in plant pathology. K2
OR
(b) Discuss in detail the concept of integrated plant disease management. K2

Q9 (a) Describe Bacterial Blight of Rice. K1
OR
(b) Describe symptoms, disease cycle and movement of Phytopthera blight. K1

Q10 (a) Discuss in detail about the Phomopsis Blight. K2
OR
(b) Explain the etiology, symptoms and management practices of the Coconut Bowl stem rot. K2

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SEMESTER END LAB EXAMINATION

Course Code: 23BOMAP232 **Offered to: B.Sc Hons Botany**

Semester: III **Max.Marks: 50 (CIA+SEE) Max. Time: 3 Hrs**

I. Answer the following. **Max. Marks: 30 Marks**

Q1. Take T.S. of the material '**A**' (Fungi), make a temporary mount and comment about identification plant pathogenic fungi. 8M

Q2. Take T.S. of the material '**B**' (Bacteria), make a temporary mount and comment about identification plant pathogenic bacteria. 8M

Q3. Take T.S. of the material '**C**' (Nematode), make a temporary mount and comment about identification plant pathogenic nematode. 8M

Q4. Write the critical notes and identify '**D**' & '**E**'. 3M

Q5. Identify and write a comment on '**F**' Koch's postulates in plant diseases. 3M

II Viva **3 Marks**

III Record **2 Marks**

(B) CONTINUOUS ASSESMENT(Internal) **15 MARKS**

TOTAL : (A)+(B) = **50MARKS**

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

Course Code				**23BOMAL233**			
Title of the Course				**PLANT BREEDING**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:		**2024-25**		**Semester:**			**III**
Course Category:	**MAJOR**			**Course Relates to:**		**GLOBAL**	
Year of Revision:				**Percentage:**		**NA**	
Type of the Course:				**SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**KNOWLEDGE OF AT +2 LEVEL**			

Course Description:

Genetic manipulation in plants has underpinned improvements in productivity and has enhanced sustainability of farming systems worldwide. As well, plant genetic diversity is fundamental to understand adaptation in natural systems. This course introduces the fundamental concepts of plant breeding and plant adaptation that are applicable to agricultural and natural systems. Extensive industry engagement is also undertaken as part of the course curriculum where students connect with industry leaders in the plant breeding discipline, whether in broad-acre cropping or horticulture. The topics covered include: genetic diversity in relation to adaptation, productivity, pest and disease resistance and end-use quality; strategies for setting breeding objectives and maximising selection and improvement of key traits; breeding methodologies for self or cross pollinated plants.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To learn the objectives of plant breeding along with reproductive methods in plants.
2	To learn the scope of plant breeding along with reproductive methods in plants.
3	To understand the breeding methods in plant for production of new varieties
4	To have a comprehensive knowledge on tools in plant breeding.
5	To have a comprehensive knowledge on techniques in plant breeding.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Compare and contrast the methods of reproduction and also pollination mechanisms.	**K2**	**4**	**2**
CO2	Design appropriate pollination method for a given crop plant.	**K6**	**4**	**2**
CO3	Recommend the best possible breeding method for a crop species.	**K5**	**4**	**1**
CO4	Propose the steps for production of hybrid varieties of crop plants.	**K6**	**4**	**1**
CO5	Apply molecular techniques to develop a tailored plant variety.	**K3**	**4**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1				**2**					**1**
CO2				**2**					**1**
CO3				**2**				**1**	
CO4				**2**				**1**	
CO5						**3**		**1**	

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1: [Basic Concepts of Plant Breeding] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study- Making a report on effect on salt stress on plant breeding.

Exercises/Projects:

Project- Written assessment on reproduction and pollination mechanisms in plants. **Evaluation method:** Awarding grade based on writing appropriate points in a descriptive way.

Specific Resources:

https://youtu.be/NaRkGTRDiLQ

Unit – 2: [Contrivances for Cross Pollination] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study- Report on pollen from fields of fiber.

Exercises/Projects:

Project- 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.

Specific Resources:

https://youtu.be/zlM5C6tXvYs

Unit – 3: [Breeding Method in Plant] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study- Assignment of yield testing.

Exercises/Projects:

Project 1- Hands on activity of selection procedure for a given crop plant.

Evaluation method: Assessment of understanding and applying appropriate selection procedure.

Specific Resources:

https://youtu.be/JPtaseBgU3k?list=PLE4QPzlkt9Kx6Wqw1NQITNbkb2L_fG7gg

Unit – 4: [Breeding Methods in Cross Pollinated Plants] (12Hrs)

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.

Examples/Applications/Case Studies:

Case Study- An overview of pedigree method

Exercises/Projects:

Project- 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.

Specific Resources:

https://youtu.be/Pz-D2EoZbD0

Unit – 5: [Modern Methods in Plant Breeding] (12Hrs)

1. Mutation breeding: spontaneous and induced mutations- characteristic features of mutations- procedure of mutation breeding-applications-advantages, limitatins 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.

Examples/Applications/Case Studies:

Case Study- Study of maize cultivation by modern methods

Exercises/Projects:

Project- 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.

Specific Resources:

https://youtu.be/3WlqbuQPzyg

TEXT BOOKS:

1. Singh, B. D. (2001) Plant breeding: Principles and methods. Kalyani Publishers, New Delhi, India.

REFERENCES:

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.

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

Course Code				**23BOMAP233**			
Title of the Course				**PLANT BREEDING**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:		**2024-25**		**Semester:**			**III**
Course Category:	**MAJOR**			**Course Relates to:**	**GLOBAL**		
Year of Revision:				**Percentage:**	**NA**		
Type of the Course:				**Skill development**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**KNOWLEDGE OF PLANT DISEASES AT +2 LEVEL**			

Course Description:

An overview of the course content and objectives.

This course is an introduction to the science of plant breeding. This course introduces the fundamental concepts of plant breeding and plant adaptation that are applicable to agricultural and natural systems. Extensive industry engagement is also undertaken as part of the course curriculum where students connect with industry leaders in the plant breeding discipline, whether in broad-acre cropping (e.g. wheat, barley, canola, faba bean breeding) or horticulture (e.g. almond breeding). The topics covered include: genetic diversity in relation to adaptation, productivity, pest and disease resistance and end-use quality; strategies for setting breeding objectives and maximizing selection and improvement of key traits; breeding methodologies for self or cross pollinated plants.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To understand the cross pollination mechanism.
2	To understand the self pollination mechanism.
3	To gain knowledge in moderm breeding methods
4	To understand the hybridization techniques.
5	To identify the plant variants based on pollination.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Distinguish self and cross-pollinated plant species based on floral biology.	**K2**	**4**	**1**
CO2	Perform skills related to self and cross pollination in plants.	**K6**	**6**	**1**
CO3	Experiment hybridization to produce new varieties.	**K3**	**6**	**1**
CO4	Apply the principles of inheritance to plant breeding	**K3**	**6**	**1**
CO5	Identify mutation breeding.	**K1**	**4**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1				**2**				**1**	
CO2				**3**				**1**	
CO3				**3**				**1**	
CO4				**3**				**1**	
CO5				**2**				**1**	

Course Structure

This lab list covers the key areas of plant breeding course, providing hands-on practice with applying the concepts in plant breeding and pollination methods.

Unit 1: [Basic concepts of plant breeding] (6Hrs)

Lab 1:

Floral biology in a self and a cross pollinated plant species.

- **Dataset** (web link) / **Experiment**:

https://www.youtube.com/shorts/K7wyQZereZg?feature=share

- **Tasks:** Identification of floral organs.

Unit 2: [Contrivances for cross pollination] (6Hrs)

Lab 1:

(1) Identification and classification of plants based on pollination mechanism.
(2) Pollen viability test.
(3) Observation on pollen germination.

- **Dataset** (web link) / **Experiment**:

https://www.youtube.com/watch?v=GtYHU1Mx4SE&pp=ygUVcG9sbGVuIHZpYWJpbGl0eSB0ZXN0

- **Tasks:** Identifying the pollen germination of different plant species.

Unit 3: [Breeding methods in plants] (6Hrs)

Lab 1: Practicing selfing technique.

- **Dataset** (web link) / **Experiment**:

https://www.youtube.com/shorts/atLQPBZ_pcs?feature=share

- **Tasks:** Differentiating self-pollinating plants.

Unit 4: [Breeding methods in cross-pollinated plants] (6Hrs)

Lab 1:

(1) Practicing emasculation technique.
(2) Practicing crossing technique.
(3) Estimation of heterosis and inbreeding depression.

- **Dataset** (web link) / **Experiment**:

https://www.youtube.com/shorts/H6rLkcyVXgo?feature=share

- **Tasks:** Differentiating cross-pollinating plants.

Unit 5: [Modern methods in plant breeding] (6Hrs)

Lab 1:

(1) Assessment of genetic variability.
(2) Studying mutant and polyploids in crop plants.

- Dataset (web link) / Experiment:

https://www.youtube.com/shorts/1_tHc8VuZ2M?feature=share

- **Tasks:** Identification of mutants.

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**23BOMAL233 PLANT BREEDING**
Offered to:	**B.Sc Hons Botany**
Category:	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks) Answer All questions. Each question carries 4 Marks.

Q1 (a) Explain about Apomixis and its types. K2
OR
(b) Explain Heritability in crop improvement. K2

Q2 (a) Explain in brief about male sterility in plant breeding. K2
OR
(b) Explain centres of origin of crop plants. K2

Q3 (a) Describe germplasm collection. K1
OR
(b) Describe the procedure of Clonal selection. K1

Q4 (a) Discuss the Emasculation methods in plant breeding. K2
OR
(b) Describe briefly dominance hypothesis. K2

Q5 (a) Explain the polyploidy breeding in crop improvement. K2
OR
(b) Discuss about marker assisted selection and its applications. K2

Section B: Long Answer Questions (50 Marks). Answer All questions. Each question carries 10 Marks.

Q6 (a) Explain the aim, objectives and scope of plant breeding. K2
OR
(b) Discuss the charcateristics of crop plants based on reproduction. K2

Q7 (a) Describe about cytoplasmic genetic male sterility. K1
OR
(b) Describe exploitation of self-incompatibility in hybrid production. K1

Q8 (a) Explain the procedure, merits and demerits of plant introduction. K2
OR
(b) Explain pure line selection methods. K2

Q9 (a) Describe the procedure, advantages, disadvantages and achievements of hybridization. K1
OR
(b) Describe about genetic basis of heterosis. K1

Q10 (a) Explain the procedure of mutation breeding. K2
OR
(b) Describe the DNA markers and their applications in plant breeding. K2

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(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

Semester End Lab Examination

Course Code: 23BOMAP233 **Offered to: B.Sc Hons Botany**

Semester: III **Max.Marks: 50 (CIA+SEE) Max. Time: 3 Hrs**

I. Answer the following. **Max. Marks: 30 Marks**

Q1. Perform the given experiment '**A**' to calculate the percentage of pollen germination. 8M

Q2. Perform the given experiment '**B**' and identify the seed viability using tetrazolium. 8M

Q3. Perform the given experiment '**C**'. 8M

Q4. Identify and write a note on '**D**'. 3M

Q5. Identify and write a note on '**E**'. 3M

II Viva **3 Marks**

III Record **2 Marks**

(B) CONTINUOUS ASSESMENT(Internal) **15 MARKS**

TOTAL : (A)+(B) = **50MARKS**

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
(An Autonomous College in the Jurisdiction of Krishna Unviersity, Machilipatnam)

Course Code				**23BOMAL234**			
Title of the Course				**PLANT BIOTECHNOLOGY**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:		**2024- 25**		**Semester:**			**III**
Course Category:		**MAJOR**		**Course Relates to:**		**GLOBAL**	
Year of Introduction:		**2024**		**Percentage**		**NA**	
Type of the Course:				**Employability , Skill developement**			
Crosscutting Issues of the Course :				**Environment and Sustainability**			
Pre-requisites, if any				**Basics of Plant Tissue culture Techniques**			

Course Description:

The course deals with the study of plant life and application of technical approaches to biological environments and living organisms. Students undertaking this course will be introduced to concepts and applications of modern plant biotechnology in agriculture. Areas to be covered include: Introduction to plant biotechnology; Tissue culture media and preparation; Sterilisation techniques; In vitro micropropagation; Application of tissue culture to plant breeding; Introduction to molecular biology; Genome organization, structure and function; Basic molecular techniques; PCR based techniques; Genetic markers; Applications of molecular; Gene Cloning; Gene transfer in plants; Transgenics in crop improvement; and Impact of recombinant DNA technology.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To familiarize the students with the key developments in the sphere of Plant Biotechnology.
2	To understand the basics principles of Plant Tissue culture Techniques.
3	To Learn Basic Sterilization Techniques used in Plant Tissue culture.
4	To acquire Knowledge of secondary metabolites and Biotransformation Techniques.
5	To Know the Applications of Transgenic plants.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	To understand the basics principles of plant sciences and molecular biology	**K1**	4	**2**
CO2	To have a knowledge of laboratory techniques used in plant biotechnology.	**K2**	4	**1**
CO3	To understand the industrial applications of biotechnology in developing new products.	**K2**	6	**1**
CO4	To undertake research in plant biotechnology.	**K3**	6	**1**
CO5	Gain basic knowledge on trait improvement in plants.	**K4**	6	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1						**2**			**1**
CO2						**2**		**1**	
CO3						**3**		**1**	
CO4						**3**		**1**	
CO5						**3**		**1**	

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1 (Basic techniques in plant tissue culture) (12Hrs)

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 organogesis; factors affecting somatic embryogenesis and organogesis synthetic seeds and their Applications.

Applications:

Assignment 1 : Basics of PlantTissue culture protocols.
Assignment 2: Laboratory safety Rules and Guidelines.
Activity 1: MS media(Murashige – Skoog) composition and preparation
Activity 2: Preparation of callus cultures

Specific Resources:

https://passel2.unl.edu/view/lesson/a2f44b5b9a27/1
https://byjus.com/biology/plant-tissue-culture/

Unit-2 Organ and haploid culture Techniques (12Hrs)

1. Importance and applications of meristem culture, zygotic embryo culture, endosperm culture.
2. Micro propagation and it's uses, commercial exploitation of micro propagation.
3. Production of haploids using anther, pollen and unfertilized ovule cultures characterization and applications.

Applications

Assignment 1: Prepare PPT on Different culture Techniques
Assignment 2: Prepare PPT on Micro propagation and it's applications

Specific Resources:

https://byjus.com/biology/tissue-culture/
https://www.geeksforgeeks.org/micropropagation/

Unit -3 Cell and protoplast cultures. (12Hrs)

1. Cell suspension-continuous and batch cultures; mass cultivation of plant cell 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 protoplast; methods used for protoplast fusion.
4. Somatic hybridization/ cybridization - selection systems for somatic hybrids/ cybrids, their characterization and applications.

Applications:

Assignment 1: Prepare PPT on Bioreactor.
Assignment 2: Prepare PPT on Secondary metabolites production

Specific Resources:

https://byjus.com/biology/tissue-culture/
https://www.geeksforgeeks.org/micropropagation/

Unit -4: Transgenic plants (12Hrs)

1. Transgenic plants - Defination, bio safety and ethical issues associated with transgenic plants.
2. Herbicide resistance (glyphosphate), insect resistance (alpha amylase inhibitor).
3. Virus resistance (coat protein mediated, nucleocapsidgene), disease resistance (antifungal proteins,PR protein).

Quality improvement (Golden rice), shelf-life enhancement (flavr savr tomato).

Applications:

Assignment 1: Prepare PPT on Transgenic plants
Assignment 2: Prepare PPT on insect resistance plants

Specific Resources:
https://www.geeksforgeeks.org/transgenic-plants/

Unit – 5 Advances in plant biotechnology **(12Hrs)**

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

Applications:
Assignment 1: Prepare PPT on Bioremediation.
Assignment 2: Prepare PPT on genetically modified foods.

Specific Resources:
https://www.slideshare.net/slideshow/applications-of-plant-biotechnology/130591402
https://delhigreens.com/2020/08/20/5-uses-of-biotechnology-in-environmental-protection/

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.

REFERENCES:

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.

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Course Code				**23BOMAP234**			
Title of the Course				**Plant Biotechnology**			
Offered to: (Programme/s)				**B.Sc Hons Botany**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:	**2024-25**			**Semester:**			**III**
Course Category:	**MAJOR**			**Course Relates to:**			**GLOBAL**
Year of Introduction:	**2024**			**Percentage:**			**NA**
Type of the Course:				**SKILL DEVELOMENT, Employability**			
Crosscutting Issues of the Course :				**Environment and Sustainability**			
Pre-requisites, if any				**Basics of Plant Tissue Culture techniques**			

Course Description:

The course deals with the study of plant life and application of technical approaches to biological environments and living organisms.

Students undertaking this course will be introduced to concepts and applications of modern plant biotechnology in agriculture. Areas to be covered include: Introduction to plant biotechnology; Tissue culture media and preparation; Sterilisation techniques; In vitro micropropagation; Application of tissue culture to plant breeding; Introduction to molecular biology; Genome organization, structure and function; Basic molecular techniques; PCR based techniques; Genetic markers; Applications of molecular; Gene Cloning; Gene transfer in plants; Transgenics in crop improvement; and Impact of recombinant DNA technology.

Course Aims and Objectives:

S. No	COURSE OBJECTIVES
1	To familiarize the students with the key developments in the sphere of Plant Biotechnology.
2	To understand the basics principles of Plant Tissue culture Techniques.
3	To Learn Basic Sterilization Techniques used in Plant Tissue culture.
4	To acquire Knowledge of secondary metabolites and Biotransformation Techniques
5	To Know the Applications of Transgenic plants

Course Outcomes

At the end of the course, the student will / will be…

NO	COURSE OUTCOME	BTL	PO	PSO
CO1	To understand the basics principles of plant sciences and molecular biology.	**K2**	**5**	**1**
CO2	To have a knowledge of laboratory techniques used in plant biotechnology.	**K1**	**6**	**1**
CO3	To understand the industrial applications of biotechnology in developing new products.	**K2**	**6**	**1**
CO4	To gain research knowledge in plant biotechnology.	**K1**	**6**	**1**
CO5	Gain basic knowledge on trait improvement in plants.	**K1**	**6**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO-PSO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1					**3**			**1**	
CO2						**3**		**1**	
CO3						**3**		**1**	
CO4						**3**		**1**	
CO5						**3**		**1**	

Course Structure:

Unit – I: (6 Hrs)

Practical 1 Equipment used in plant tissue culture

Aim: Requirements for Plant Tissue Culture Laboratory.

Laboratory Requirements: 'Plant tissue culture' or in vitro cultivation of plants basic requirements:

(a) Cultivation should be done under aseptic conditions.

(b) The isolated plant part should get an appropriate environment which will help to divide the cell and to get an expression of internal potential.

Basic facilities for plant tissue culture operations involving any type of in-vitro procedures must include:

(a) Washing and storage facilities;

(b) Media preparation, sterilisation and storage room;

(c) Transfer area for aseptic manipulations;

(d) Culture rooms or incubators for maintenance of cultures under controlled conditions of temperature, light and humidity;

(e) Observation or data collection area;

(f) Transplantation area.

Washing and Storage Facilities:

An area with large sink (lead lined to resist acids and alkalis) and draining area is necessary with provision for running water, draining-boards or racks and ready access to a de-ionized, distilled and double-distilled apparatus. Space should also be available to set up drying ovens, washing machines, plastic or steel buckets for soaking labware, acid or detergent baths, pipette washers, driers and cleaning brushes. For storage of washed and dried labware, the laboratory should be provided with dustproof cupboards or storage cabinets.

Media Preparation Room or Space:

This part is the central section of the laboratory where most of the activities are performed i.e., media preparation and sterilisation of media and glassware's needed for culture. There should be sufficient working bench as well as storage space.

The following items are essential in the room:

(i) Different types of glassware

(ii) Different kinds of balances

(iii) Required chemicals

(iv) Hot plates and Stirrer

(v) Water bath

(vi) pH meter

(vii) Autoclave and Hot air oven

(viii) Microwave oven

(ix) Vortex, Shaker

(x) Centrifuge

(xi) Refrigerator and Freezer

(xii) Storage cabinet (Dust-free)

Transfer Area:

Tissue culture techniques can only be successfully carried out in a very clean laboratory having dry atmosphere with protection against air-borne microorganisms. For this purpose a sterile dust-free room/cabinet is needed for routine transfer and manipulation work.

The 'laminar air flow cabinet' is the most common accessory used for aseptic manipulations now-adays. The cabinet may be designed with horizontal air flow or vertical air flow where the air is forced into the cabinet through a bacterial HEPA (High Efficiency Particulate Air) filter. The air flows over the working bench at a constant rate which prevents the particles (microorganisms) from settling on the bench. Before operation in the laminar air flow cabinet, the interior of the cabinet is sterilised with the ultraviolet (UV) germicidal light and wiping the floor of cabinet with 70% alcohol. Inoculation chamber, a specially designed air tight glass chamber fitted with UV light, may also be used as transfer area.

Culture Room:

Plant tissue cultures should be incubated under conditions of well-controlled temperature, illumination, photoperiod, humidity and air circulation. Incubation culture rooms, commercially available incubator cabinets, large plant growth chambers and walk-in- environmental rooms satisfy these requirements. Culture rooms are constructed with proper air-conditioning; perforated shelves to support the culture vessels, fitted with fluorescent tubes having a timing device to maintain the photoperiod, black curtains may be used to maintain total darkness. For the suspension cultures, gyratory shakers are used. Air conditioners and heaters are used to maintain the temperature around 25 ± 2°C and humidity is maintained by uniform forced air-ventilation.

Data Collection Area:

The growth and development of tissues cultured in vitro are generally monitored by observing cultures at regular intervals in the culture room or incubators where they have been maintained under controlled environmental conditions. Arrangement should be there where the observations can be done under aseptic conditions using microscope. Special facilities are required for germplasm conservation i.e., cryopreservation accessories should be there.

Transplantation Area:

Plants regenerated from in vitro tissue culture are transplanted to soil in pots. The potted plants are ultimately transferred to greenhouse but prior to transfer the tissue culture grown plants are allowed for acclimatization under well humid condition and controlled temperature and under controlled entry of sunlight.

Practical 2: Sterilization Techniques in plant tissue culture laboratory.

Sterilization Procedure:

Principle: The culture medium, especially when it contains sugar, will also support the growth of micro-organisms like bacteria, fungi etc. So if they come in contact with medium either in cellular form or in spore form, the micro-organisms grow faster than the higher plant tissue due to their brief life cycle and will kill the tissue. The micro-organisms may come from glass vials, instruments, nutrient medium used for culture and even from plant material itself. Therefore, the surface of plant tissue and all non-living articles including nutrient medium should be sterilized.

Procedure:

(i) Sterilization of non-living Articles: The routine sterilization procedure of non-living articles such as nutrient medium, glass goods, distilled water, instruments (wrapped with brown paper) is by autoclaving under steam at a pressure of 15 lb/in2 and a temperature of 120°C for 15 minutes. Thermolabile compounds are often added in the medium and such medium is sterilized either at room temperature or in cold by passing through bacterial filter.

An alternative method of sterilizing glass goods and instruments is by heating in an oven at 150°C for 34 hrs. It should be noted that when autoclaving screw capped glass vials, care should

be taken to ensure that the caps are not closed too tightly so that gases can expand without the risk of explosion.

Unit – II: (6 Hrs)

Practical 3. Preparation of culture media

Principle: Isolated cell, tissues and organs need nutrients for their in vitro growth and development. So, nutrients are supplied artificially according to the medium formulated by several workers. The main objective of medium preparation is to culture the cell, tissue and organ in vitro.

Procedure:

Media should be prepared with care and the following procedure is recommended. To make 1litre of MS medium: (i) Dissolve 30gms cane sugar in 200 ml DDH2 O. Mix 1-2gms activated charcoal and filter through filter paper, set inside the Buchner funnel fitted on a special conical flask with small side arm attachment. Filtering is done by using a suction pump. (ii) Take DDH2 O in another flask and add in sequence the appropriate amount of stock solution as follows

Stock solution of macrosalts	50 ml
Stock solution of microsalts	1 ml
Stock solution of KI	1 ml
Stock solution of Fe-EDTA	5 ml
Stock solution of MS 3 vits	1 ml
Stock solution of Glycine	1 ml
Stock solution of meso-inositol	2 ml

Desired concentrations of auxin and/or cytokinin are added from stock solution according to the formula: Desired concentration/Stock concentration = amount (ml) of stock solution to be taken for one litre medium.

If the quantity of the medium is less than one litre, then hormones are added using another formula— Required concentration X Volume of medium/Stock concentration X1, 000 = amount (ml) of stock solution to be added.

(iii) Pour filtered sucrose solution and salt, vitamins, amino acid, hormone solution mixture into a one litre measuring cylinder. Make the final volume to one litre with DDH2 O. Shake well to mix up uniformly.

(iv) Adjust the pH of the liquid medium 5.6-5.8 with the aid of 0.1(N) HCl or 0.1(N) NaOH. This operation is done using the pH metre.

(v) Add 5% to 8% agar to the liquid medium to make solid medium. Heat to 60°C to dissolve the agar completely. Otherwise, without adding agar, liquid medium can be used for culture.

(vi) Dispense the culture medium into culture tube (20 ml/tube) or wide mouth conical flask (25-40 ml/flask). Insert non-absorbent cotton plug wrapped with gauge cloth. Cover the plug with the help of brown paper and rubber band.

(vii) Medium is finally sterilized by autoclaving.

Practical 4: Callus induction and sub culturing

Aim:- To induce callus from explant. Callus is an actively-dividing non-organized mass of undifferentiated and differentiated cells often developing either from injury or in tissue culture in the presence of growth regulators. Explants from both mature and immature organs can be induced to form callus. However, explants with mitotically active cells (young, juvenile cells) are generally good for callus initiation. Callus is produced on explants invitro from peripheral layers as a result of wounding and in response to growth regulators,either endogenous or exogenously supplied in the medium. The season of the year, donor conditions of the plant, the age and physiological state of the parent plant contribute to the success of organogenesis in cell cultures.Growth regulator concentration in the culture medium is critical for morphogenesis. Auxin, at a moderate to high concentration, is the primary hormone used to produce callus. In

some species, a high concentration of auxin and a low concentration of cytokinin in the medium promotes abundant cell proliferation with the formation of callus. Callus may be serially subcultured and grown for extended periods, but its composition and structure may change with time as certain cells are favoured by the medium and come to dominate the culture.

Reagents and other requirements

1. Culture tubes or conical flasks containing media
2. Sterile Petri dishes
3. Scalpel, blades, forceps and steel dissecting needles
4. Sterile distilled water
5. Alcohol
6. Detergent (Tween 20, Teepol, etc.)
7. Sterilants – HgCl2, Sodium Hypochlorite
8. Nutrition medium reagents – MS basic salts and vitamins Growth regulators – 2, 4-D

Plant material – Green gram

Media

Seed Germination: MS Medium Callus Induction: MS + 2, 4-D (2mg/lL) I. Seed Germination

1. The seeds washed by submerging in water with a few drops of detergent in a beaker with vigorous shaking.
2. The seeds were submerge in 70% alcohol for 40 s after which the alcohol was decanted.
3. The seeds were transfer to a flask containing 20% commercial sodium hypochlorite solution and left there for 20 min for surface sterilization. Later they were rinsed thrice with sterile distilled water.
4. 2-3 seeds were placed on the surface of MS medium and incubated at 25oC for 16h photoperiod with 250µE/m2/ s light intensity for 2 weeks.
5. Observe regularly for germination. If need be, transfer the individual plantlets to half MS medium.

II. Callus Induction

1. The leaves were removed from in vitro germinated seeds and were cut into pieces and placed on the MS medium. As a control measure, some explants should be inoculated on MS medium without hormones.
2. The cultures were incubated in dark at 25oC. Callus started appearing within 2 weeks and good callus growth can be observed in 3-4 weeks.
3. Callus can be sub-cultured after the 4th week on fresh medium with the same composition.

Result: The undifferentiated mass of cells was formed from the inoculated leaf explant.

Unit – III: (6 Hrs)

Practical 5: Organogenesis using PGRs

Practical 6: Demonstration of cell protoplast cultures

Unit – IV: (6 Hrs)

Practical 7: Demonstration of organ culture

Unit – V: (6 Hrs)

Practical 8 **:** Demonstration of another and pollen culture.

Virtual labs/demos

RFERENCE WEB LINKS:

https://www.onepointesolutions.com/blog/tissue-culture-lab-equipment/

https://labassociates.com/4-methods-of-sterilization-used-in-plant-tissue-culture

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA:: VIJAYAWADA-10
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SEMESTER -END MODEL QUESTION PAPER

Course Code & Title of the Course:	**23BOMAL234**
Title:	**PLANT BIOTECHNOLOGY**
Offered to:	**B.Sc Honours Botany**
Category: Major	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions Answer All questions.
Each question carries 4 Marks. Marks: 20

Q1 (a) Describe the term totipotency, dedifferentiation and redifferentiation. K1
OR
(b) Describe the process of callus culture. K1

Q2 (a) Explain the importance and few applications of meristem. K2
OR
(b) Discuss the steps involved in embryo culture. K2

Q3 (a) Explain cell suspension culture - Batch and Continuous cultures. K2
OR
(b) Explain Cybridization. K3

Q4 (a) Explain about Golden rice as quality improvement. K2
OR
(b) What are transgenic plants? Explain with examples. K2

Q5 (a) Describe the Bio-fortification. K2
OR
(b) Explain about Bioremediation. K2

Section B: Long Answer Questions Answer All questions. Each question carries 10 Marks. Marks: 50

Q6 (a) Explain the Sterilization Techniques in detail. K2
OR
(b) What is somatic embryogenesis? Explain various factors affecting somatic embryogenesis. K2

Q7 (a) Define micro propagation. Describe its commercial exploitation of micro propagation. K1
OR
(b) Describe the haploid culture in detail. K1

Q8 (a) Define protoplast culture. Explain various methods of protoplast cultures. K2
OR
(b) Define hybrid. Explain the somatic hybrids and cybrids. K2

Q9 (a) Discuss about Herbicide resistant and insect resistant transgenic plants with suitable examples. K1
OR
(b) Discuss about virus resistant transgenic plants. K1

Q10 (a) Explain about various plant based vaccines and the therapeutic drugs with examples. K2
OR
(b) Explain various applications of plant biotechnology in production of bio energy and Bioremediation process. K2

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Semester End Lab Examination

Course Code: 23BOMAP234 **Offered to: B.Sc Hons Botany**

Semester: III **Max.Marks: 50 (CIA+SEE) Max. Time: 3 Hrs**

I. Answer the following. **Max. Marks: 30 Marks**

Q1. Perform the given experiment '**A**' and write the preparation procedure. 8M

Q2. Write the procedure for given experiment **'B'**. 8M

Q3. Write the procedure for given experiment **'C'**. 8M

Q4. Identify and write a note on '**D**' & '**E**'. 3M

Q5. Identify and write a note on '**F**'. 3M

II Viva **3 Marks**

III Record **2 Marks**

(B) CONTINUOUS ASSESMENT(Internal) **15 MARKS**

TOTAL : (A)+(B) = **50MARKS**

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