

Chaudhary Bansi Lal University, Bhiwani

(A State University established under Haryana Act No. 25 of 2014)



Scheme of Examinations & Syllabi

for

Botany

(w.e.f. 2024-25)

in

Undergraduate Programmes
as per NEP 2020

✓
make it
common.

Curriculum and Credit Framework for Undergraduate Programmes
(Multiple Entry-Multiple Exit, Internship and Choice Based Credit System LOCF)
With effect from the session 2024-25 (in phased manner)

DEPARTMENT OF BOTANY

Chaudhary Bansi Lal University, Bhiwani
HARYANA, INDIA

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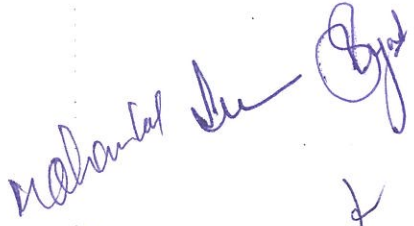
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SEMESTER-3									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A, B & C	CC-3 MCC-4 4 credit	24UN- BOT-301	Gymnosperms & Plant Anatomy	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
Scheme B & C	MCC-5 4 credit	24UN- BOT-302	Ecology	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
Scheme A & C	CC-M3 4 credits	From Available CC-M3/MCC-3 of 4 credits as per NEP							
Scheme B only	CC-M3(V) 4 credits	From Available CC-M3(V) of 4 credits as per NEP							
Scheme A, B & C	MDC-3 3 credits	From available pool of Multidisciplinary Courses from a subject of different discipline as per NEP							
Scheme A, B & C	AEC-3 2 credit	From Available AEC-3 of two credits as per NEP							
	SEC-3 3 credit	From Available SEC-3 of three credits as per NEP							
Scheme C only	VAC-3 2 credits	From Available VAC-3 of two credits as per NEP							
Scheme B only	MCC-3	MCC-2 FROM SCHEME C OF FIRST SEMESTER							



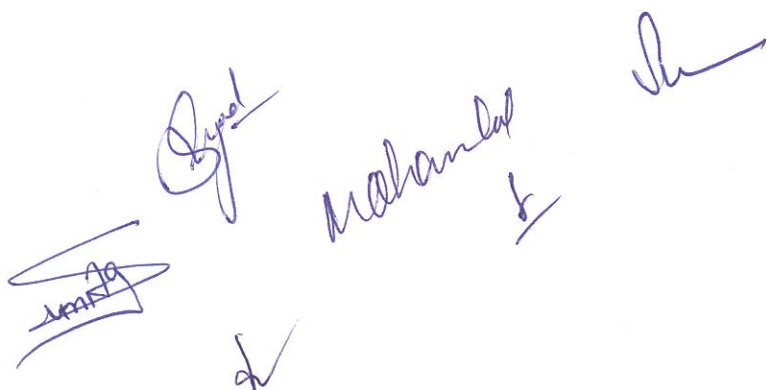



SEMESTER-4									
Remarks	Course	Paper (s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A, B & C	CC-4 MCC-6 4 credit	24UN- BOT-401	Plant Systematics & Embryology	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
Scheme B & C	MCC-7 4 credit	24UN- BOT-402	Plant Molecular Biology	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
Scheme B & C	MCC-8 4 credit	24UN- BOT-403	Microbiology	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
Scheme B & C	DSE-1 4 credit	24UN- BOT-404	Plant Tissue Culture	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
	Select one option	24UN- BOT-405	Bioethics, Biosafety and IPR	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
Scheme A, B & C	CC-M4(V) 4 credits	From Available CC-M4(V) of 4 credits as per NEP							
	AEC-4 2 credit	From Available AEC-3 of two credits as per NEP							
Scheme C only	VAC-4 2 credits	From Available VAC-4 of two credits as per NEP							
Scheme A & B	VAC-3 2 credits	From Available VAC-3 of two credits as per NEP							
Internship of 4 credits of 4-6 weeks duration after 4th Semester (if not done after second semester)									




Pool of MDC, VAC, SEC and VOC Courses for scheme A, B, C & D in the subject of Botany to be offered to the University Pool

Course Type Total Credits	SEM	Course Code	Nomenclature of the Course	Credits	Contact hours per week	Internal Assessment Marks	End term Examination Marks	Total Marks	Examination Hrs.
MDC-1 03 Credits	I	24UN-BOT- MDC101	Fundamentals of Botany	02	02	15	35	50	03
			Practical	01	02	05	15	20	03
MDC-2 03 Credits	II	24UN-BOT- MDC201	Economic Botany	02	02	15	35	50	03
			Practical	01	02	05	15	20	03
MDC-3 03 Credits	III	24UN-BOT- MDC301	Ornamental Plants and Propagation	02	02	15	35	50	03
			Practical	01	02	05	15	20	03
VAC-1	I/II	24UN-BOT- VAC101	Environmental Studies	02	02	15	35	50	03
VAC-3	III	24UN-BOT- VAC301/401	Medicinal Plants in Everyday Life	02	02	15	35	50	03
VAC-4	IV								
SEC-2	II	24UN-BOT- SEC201	Organic Farming	02	02	15	35	50	03
			Practical	01	02	05	15	20	03
SEC-3	III	24UN-BOT- SEC301	Herbal Technology	02	02	15	35	50	03
			Practical	01	02	05	15	20	03
SEC-4	VI	24UN-BOT- SEC601	Floriculture	02	02	15	35	50	03
			Practical	01	02	05	15	20	03
CC-M3 (V)	III	24UN-BOT- VOC301/501	Biofertilizers	02	02	15	35	50	03
CC-M5 (V)	V		Practical	02	04	15	35	50	04
CC-M4 (V)	IV	24UN-BOT- VOC401	Nursery and Gardening	02	02	15	35	50	03
			Practical	02	04	15	35	50	04
CC-M5 (V)	VI	24UN-BOT- VOC601	Mushroom Cultivation	02	02	15	35	50	03
CC-M6 (V)									
CC-M7 (V)			Practical	02	04	15	35	50	04



Syllabus
Subject: Botany
Third Semester

Part A - Introduction

Subject	BOTANY		
Semester	3rd		
Name of the Course	Gymnosperms and Plant Anatomy		
Course Code	24UN-BOT-301		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-3/MCC-4		
Level of the course (As per Annexure-I)	100-109		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Students will gain knowledge of general characteristics of gymnosperms. 2. Students will gain knowledge about comparison between gymnosperms and economic importance. 3. Students will gain an understanding of various kind of tissue system in plants and secondary growth. 4. Students will acquire knowledge about leaf and root, morphology and anatomy. 5*. Students will gain the knowledge of practical aspects of gymnosperms and plant anatomy.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5

THEORY

Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50	Time: 3 Hours
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PRACTICAL

Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20	Time: 4 Hours
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Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	Gymnosperms- General characteristics, classification up to classes (Pelger and Melchior, 1954), Affinities of gymnosperms with Pteridophytes and angiosperms, geological time scale, Economic importance	11

II	Morphology, anatomy and reproduction of <i>Cycas</i> , <i>Pinus</i> (developmental details not to be included).	11
III	Tissues system in Plants: Shoot apical meristems, Meristematic and permanent tissue (Simple, complex and secretory tissue), Tissue system (Epidermal, ground and vascular). Secondary growth: Vascular cambium-structure and function, Primary Structure of monocot stem, Secondary growth in dicot stem, Wood (heartwood and sapwood), Abnormal Secondary growth in <i>Dracaena</i> and <i>Boerhavia</i> .	11
IV	Leaf and protective systems in plants: Types of leaves (Simple and compound), Phyllotaxy, Epidermal appendages and their morphological Types, Anatomy of monocot and dicot leaf, Stomatal apparatus and their morphological types, Leaf abscission, Venation, Function of Leaf. Root system & its modification: Root apical meristem, Structure of monocot and dicot root, Secondary growth in dicot root.	12
V*	1. Morphological study of <i>Cycas</i> and <i>Pinus</i>. 2. Anatomical studies of <i>Cycas</i> and <i>Pinus</i>. 3. Study of Tissues through Permanent slides/photographs/ charts. 4. To prepare the double stain permanent mount of monocot and dicot stem and root (normal / abnormal secondary growth) 5. To study morphology and anatomy of Dicot and Monocot leaf. 6. To study types of leaves and their collection.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: ➤ Practicum • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: • Mid-Term Exam:		End Term Examination:
Part C-Learning Resources		
Recommended Books/e-resources/LMS: • Bhaniagar, S.P. and Moitm, A, Gymnosperms. New Age International Pvt. Ltd., New Delhi. • Singh, H. Embryology of Gymnosperms, Encyclopedia of Plant Anatomy Gebruder Bortraeger, Berlin, Germany • Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Gymnosperms, S. Chand. Delhi, India • Mauseth, J.D., Plant Anatomy. Publisher: The Blackburn Press. • Cutter, E.G., Plant Anatomy Part-I, Cells and Tissues, Edward Arnold, London. 2nd edition. • Esau, K., Anatomy of Seed Plants, John Wiley & Sons, New York. 2nd edition. • Stace, C.A., Plant Taxonomy and Biosystematics. Edward Arnold, London. 2nd edition.		





Session : 2024-25			
Part A - Introduction			
Subject	BOTANY		
Semester	3 rd		
Name of the Course	Ecology		
Course Code	24UN-BOT-302		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-5		
Level of the course (As per Annexure-I	100-109		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1: Students will comprehend the fundamental principles of biodiversity. 2: Students will acquire a conceptual understanding of the classifications used by the IUCN. 3: Students will acquire knowledge about the principles of conservation laws and international legislation. 4: Students will develop a foundational understanding of international legislation. 5*. Student will learn about the practical approaches to protect and restore the biological communities.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50	Time: 3 Hours		
PRACTICAL			
Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20	Time: 4 Hours		

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

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Unit	Topics	Contact hours
I	Introduction to Ecology: Autoecology and Synecology, Laws of limiting factors, Study of physical factors: Temperature and Light. Population: Unique and group attributes of population: density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion; Exponential and logistic growth, equations and patterns, r and k strategies.	11
II	Species Interactions: Types of species interactions, Habitat and Niche concept; Predation- predator defense mechanisms. Community: Community characteristics: species richness, dominance, diversity, abundance, guilds, ecotone and edge effect; Ecological succession with examples and types.	11
III	Ecosystem: Types of Ecosystems: Terrestrial ecosystem, vertical stratification in tropical forest; Food chain: detritus and grazing food chains, linear and Y-shaped food chains, food web; Energy flow through the ecosystem; Ecological pyramids and Ecological efficiencies.	11
IV	Applied Ecology: Ecology in wildlife conservation and management, Protected areas: National Parks, Biosphere reserves and Sanctuaries; Restoration ecology, Principles of Environmental impact assessment.	12
V *	- Study of life tables and plotting of survivorship curves of different types from hypothetical/ real data - Determination of population density, abundance and frequency in a natural or a hypothetical community by quadrat method. - Study of an aquatic ecosystem: a) Phytoplankton and zooplankton b) Measurement of temperature, turbidity/penetration of light, determination of pH c) Dissolved oxygen content, chemical oxygen demand d) Free carbon dioxide and alkalinity - Study of ten endemic plants of India with slides/pictures/videos. - Report on a visit to a National Park/Biodiversity Park/Wildlife Sanctuary.	30
Suggested Evaluation Methods		
Internal Assessment: > Theory - Class Participation: - Seminar/presentation/assignment/quiz/class test etc.: - Mid-Term Exam:		End Term Examination:





➤ **Practicum**

- Class Participation:
- Seminar/Demonstration/Viva-voce/Lab records etc.
- Mid-Term Exam:

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Odum, E.P. and Barrett G. W. Fundamentals of Ecology. Indian Edition Publisher: Brooks/Cole.
- Smith T. M. and Smith R. L. Elements of Ecology. Publisher: Benjamin Cummings.
- Saha G.K. and Mazumdar S. Wildlife Biology, An Indian Perspective. Publisher: PHI Learning Private Limited
- Zimmer C. and Emlen D. J. Evolution: Making Sense of Life, Roberts & Co.
- Futuyma, Douglas and Mark, Kirkpatrick. Evolutionary Biology, Oxford University Press

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Syllabus
Subject: Botany
Fourth Semester

Session : 2025-26			
Part A - Introduction			
Subject	BOTANY		
Semester	4 th		
Name of the Course	Plant Systematics and Embryology		
Course Code	24UN-BOT-401		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-4/MCC-6		
Level of the course (As per Annexure-I)	100-109		
Pre-requisite for the course (if any)			
Course Learning Outcomes(LO):	After completing this course, the learner will be able to: 1. Students will gain knowledge about taxonomy, including the rules of nomenclature and other essential aspects. 2. Students will acquire a conceptual understanding of angiosperm classification systems and the diversity of families within them 3. Students will acquire knowledge about structural organization of flower and pollination. 4. Students will develop an understanding of fertilization, embryo and endosperm development. 5*. Students will acquire the knowledge of experimentation performed for plant systematics and embryology.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50	Time: 3 Hours		
PRACTICAL			
Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20	Time: 4 Hours		
Part B- Contents of the Course			
Instructions for Paper- Setter			
1. Nine questions will be set in all. All questions will carry equal marks. 2. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.			
Unit	Topics		Contact Hours
I	Botanical nomenclature and major rules of ICBN ; Keys to identification of plants. General introduction and importance of herbaria, botanical gardens, floras, monographs and journals. Role of cytotaxonomy and chemotaxonomy, numerical taxonomy in taxonomy.		11

II	Artificial, natural and phylogenetic classifications. Bentham and Hooker system of classification (upto series), Diagnostic features and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Leguminosae, Lamiaceae, Solanaceae, Asteraceae, Liliaceae, Poaceae.	11
III	Structural organization of flowers: Structure & development of anther and pollen grain; Structure and types of ovules, Types of embryo sacs, organization and ultrastructure of mature embryo sac, Types of Placentation. Pollination: Pollination mechanisms and adaptations, pollen pistil interaction, self-incompatibility, Significance of self and cross pollination.	12
IV	Fertilization and seed dispersal: Double fertilization, Seed structure (monocot and Dicot), Endospermic & non-endospermic seeds, Types of Fruits, seed dispersal mechanisms. Biology of embryo and endosperm: Endosperm: Structure, types and functions, Dicot and monocot embryo, Polyembryony, Seed germination (Epigeal and hypogeal), Apomixis.	11
V*	- Describe/Compare the given flower A and B in Semi technical language giving V.S. of flower, T.S. of ovary (ies), floral diagrams, floral formulae and systematic position according to Bentham & Hooker's system of classification. - Identify the important characters for Inflorescence & placentation. - Field visit along with field report and preparation of herbarium. - Dissect out the globular/heart-shaped embryo from the plant materials. - Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/campylotropous. - To study pollen germination and viability.	30

Suggested Evaluation Methods

Internal Assessment:

> Theory

- Class Participation:
- Seminar/presentation/assignment/quiz/class test etc.:
- Mid-Term Exam:

> Practicum

- Class Participation:
- Seminar/Demonstration/Viva-voce/Lab records etc.
- Mid-Term Exam:

End Term Examination:

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Radford, A.E., Fundamentals of Plant Systematics. Harper and Row, New York.
- Simpson, M.G., Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
- Singh, G., Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
- Bhojwani, S.S. & Bhatnagar, S.P., Embryology of Angiosperms. Vikas Publication, House, Pvt. Ltd. New Delhi.
- Sharma, H.P., Plant Embryology: Classical and Experimental. Alpha Science International.

Session: 2025-26			
Part A - Introduction			
Subject	BOTANY		
Semester	4 th		
Name of the Course	Plant Molecular Biology		
Course Code	24UN-BOT-402		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-7		
Level of the course (As per Annexure-I)	100-109.		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Students will gain an understanding of the essential characteristics of DNA. 2: Students will acquire comprehensive knowledge about RNA and its functions. 3: Students will acquire knowledge about proteins, including their structure and functions. 4: Students will develop a comprehensive understanding of the mechanisms and regulation of gene expression. 5*. Students will acquire the knowledge of experimentation performed for the identification of DNA/RNA as genetic material, estimation of DNA/RNA, and bacterial growth medium.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20		Time: 4 Hours	
Part B- Contents of the Course			
Instructions for Paper- Setter			
3. Nine questions will be set in all. All questions will carry equal marks. 4. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.			
Unit	Topics	Contact Hours	
I	Nucleic acids: Historical perspective; Types of genetic material, DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty), Structure of DNA, Nucleosome model. DNA replication mechanism (Prokaryotic and eukaryotic).	12	
II	Structure and function of different types of RNA, transcription (prokaryotic and eukaryotic), RNA processing: capping, splicing, polyadenylation.	11	

III	Genetic code, Types of Ribosome, Translation mechanism (prokaryotic and eukaryotic), translational inhibitors, Post-translational modification of proteins.	11
IV	DNA repair and recombination, Regulation of gene expression in prokaryotes and eukaryotes, role of chromatin in gene expression.	11
V*	Demonstration/ experimentation of following : • Isolation of genomic DNA. • Agarose gel electrophoresis. • DNA estimation by diphenylamine reagent/UV Spectrophotometry. • RNA estimation. • Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments).	30

Suggested Evaluation Methods

Internal Assessment: > Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: > Practicum • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc. • Mid-Term Exam:	End Term Examination:
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2021. Molecular Cell Biology, W.H. Freeman and Co., New York., USA. 9th edition.
- Karp, G. Iwasa, J. Marshall W. 2019. Cell and Molecular Biology. Concepts and Experiments. John Wiley and Sons. New York. 9th edition.
- Krebs, J.E. Goldstein E.S. Kilpatrick S.T. 2017. Lewin's Genes XII. Jones and Bartlett Publishers, Inc. 12th edition.
- Watson, J.D. 2017. Molecular Biology of the gene. Pearson Education India. 7th edition.
- Cooper, G.M. and Hausman, R.E. 2013. The Cell: A Molecular Approach. Sinauer Associates, Sunderland, Massachusetts U.S.A. 6th edition.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2008. The World of the Cell. Pearson Benjamin Cummings Publishing, San Francisco. 7th edition.
- Alberts, B. Johnson A. Lewis, J. Raff, M. Roberts K. & Walter P. 2007. Molecular Biology of Cell. W.W. Norton & Company. 5th edition.
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. Lippincott Williams and Wilkins, New York. 8th edition.
- Sen, S. Kar, D.K. Johri, B.M. 2005. Cytology and Genetics. Alpha Science International Ltd.

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Session : 2024-25			
Part A - Introduction			
Subject	BOTANY		
Semester	4 th		
Name of the Course	Microbiology		
Course Code	24UN-BOT-403		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-8		
Level of the course (As per Annexure-I)	100-109		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Students will gain an understanding of the general characteristics and applications of microbes. 2: Students will acquire knowledge about various methods of microbial growth and culture. 3: Students will acquire knowledge about morphological and Metabolic Characteristics of Specialized Microbes. 4: Students will develop a comprehensive understanding of genetic variations, mutagenesis, food and medical microbiology. 5*. This course will provide an understanding of the structure, nutrition, metabolism, growth, classification and identification of microorganisms.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50	Time: 3 Hours		
PRACTICAL			
Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20	Time: 4 Hours		
Part B- Contents of the Course			
Instructions for Paper- Setter			
5. Nine questions will be set in all. All questions will carry equal marks. 6. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.			
Unit	Topics	Contact Hours	
I	Introduction, branches and applications of microbiology. Classification and characteristic features of bacteria, archaea and viruses , concept of viroids, virusoids and prions. Ultrastructure of bacteria, archaea and viruses.	11	
II	Isolation of microbes from natural and artificial sources, various techniques to establish a pure culture, different methods of sterilization. Microbial growth and culturing, factors affecting microbial growth.	11	
III	Nutritional categories of microbes. biological nitrogen fixation, nitrifying and denitrifying bacteria, sulphur oxidizing and	12	

	reducing bacteria, iron oxidizing bacteria, hydrogen bacteria. Concept of rhizosphere and phyllosphere.	
IV	Food and medical microbiology: food preservation by different methods (high and low temperature, chemical additives and irradiation). Microbial toxins and food poisoning caused by <i>Clostridium botulinum</i> , <i>Salmonella sp.</i> , <i>Yersinia enterocolitica</i> , <i>Vibrio sp.</i> , and <i>Bacillus sp.</i> , Characteristics of disease causing microbes with special emphasis on mycoplasma, rickettsias, and chlamydias.	11
V*	• Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle. • Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule. • Gram staining. • Endospore staining with malachite green using the (endospores taken from soil bacteria)	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: ➤ Practicum • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc. • Mid-Term Exam:		End Term Examination:
Part C-Learning Resources		
Recommended Books/e-resources/LMS: • Microbiology: Principles and Explorations by Black JG, Prentice Hall. • Microbiology by Pelczar Jr MJ, Chan ECS, and Krieg NR, Tata McGraw Hill. • General Microbiology by Stanier RY, Ingraham JL, Wheelis ML and Painter PR, McMillan. • Prescott Microbiology by Willey JM, Sherwood LM, and Woolverton CJ, McGraw Hill Higher Education. • Microbiology: An Introduction by Gerard J Tortora et al., Pearson publications. • Microbiology: With Diseases by Body System by Robert W Bauman, Pearson publications. • Microbiology: With Diseases by Taxonomy by Robert W Bauman, Pearson publications.		

Session : 2024-25			
Part A - Introduction			
Subject	BOTANY		
Semester	4 th		
Name of the Course	Plant Tissue Culture		
Course Code	24UN-BOT-404		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	DSE-1		
Level of the course (As per Annexure-I)	100-109		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Students will acquire a fundamental understanding of plant tissue culture. 2: Students will develop comprehensive knowledge about various culture methods used in plant tissue culture. 3: Students will gain knowledge about the basic principles of recombinant DNA technology. 4: Students will develop a comprehensive understanding of transgenic plants, including methods of gene transfer and selection. 5*. Students will gain the knowledge about the tools and techniques used for in vitro plant cell/tissue culture, growth medium, culturing of explants, gene transfer methods genetically modified plants/crops.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50	Time: 3 Hours		
PRACTICAL			
Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20	Time: 4 Hours		
Part B- Contents of the Course			
Instructions for Paper- Setter			
1. Nine questions will be set in all. All questions will carry equal marks. 2. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.			
Unit	Topics		Contact Hours
I	Plant Tissue Culture: Introduction/Concept, History, Scope and Applications along with major achievements. Plant Tissue Culture Laboratory: Layout and organization, different work areas, infrastructure/equipments and instruments and other requirements. Aseptic Techniques: General sanitation/cleanliness of PTC laboratory and precautions regarding maintenance of aseptic conditions, Washing, drying and sterilization of glassware, sterilization of media, surface sterilization, aseptic work station.		11

II	Culture Media: Nutritional requirements for plant tissue culture, role of different media components, plant growth regulators, different culture media viz. MS, B5 Nitsch and White's medium, Preparation of culture media. cellular totipotency, dedifferentiation and redifferentiation, Explants culture, suspension culture and single cell culture techniques. Micropropagation and somaclonal variation.	11
III	Protoplast culture: Protoplast isolation, viability test, protoplast culture. Somatic hybridization, protoplast fusion techniques (chemical and electro-fusion), selection of hybrids, production of symmetric and asymmetric hybrids and cybrids. Practical applications of somatic hybridization and cybridization.	12
IV	Organ culture: Anther & Pollen culture, ovary, ovule, embryo and endosperm culture: concept, technique, applications and limitations. Embryo rescue. Artificial seed production. Hardening and Acclimatization	11
V*	- Brief introduction to the components and working of the instruments- oven, autoclave, incubator, centrifuge, laminar air flow and spectrophotometer); Familiarization with basic equipments in tissue culture. - Preparation of MS medium. - To prepare the slants and petri plates for plant tissue culture. - Demonstration of <i>in vitro</i> sterilization and inoculation methods using leaf and nodal explants of tobacco, <i>Datura</i>, <i>Brassica</i> etc. - Study of anther, embryo and endosperm culture, micropropagation. - Somatic embryogenesis & artificial seeds.	30

Suggested Evaluation Methods

Internal Assessment: > Theory - Class Participation: - Seminar/presentation/assignment/quiz/class test etc.: - Mid-Term Exam: > Practicum - Class Participation: - Seminar/Demonstration/Viva-voce/Lab records etc. - Mid-Term Exam:	End Term Examination:
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Stewart C.N. 2016. Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A. 2nd edition.
- Singh. B.D. 2016. Biotechnology. Kalyani Publishers. 5th edition.
- Beyl, C.A. & Trigiano, R.N. 2014. Plant Propagation Concepts and Laboratory Exercises. CRC Press, Boca Raton, FL. 2nd edition.
- MacDonald, P.T. 2014. The Manual of Plant Grafting: Practical Techniques for Ornamentals, Vegetables, and Fruit. Timber Press, Portland, OR.
- Kyte, L., J. Kleyn, H. Scoggins & M. Bridgen. 2013. Plants from Test Tubes: An Introduction to Micropropagation, Timber Press Inc., Portland, OR. 4th edition.
- Smith, R.H. 2013. Plant Tissue culture: techniques and experiments. Elsevier. 3rd edition.
- Bhojwani, S.S. & Razdan, M.K. 2009. Plant tissue culture: Theory and Practice. Elsevier India Pvt. Ltd.
- George, E.F., Hall, M.A., Klerk, G.J. 2008. Plant Propagation by Tissue Culture. Springer. 3rd edition

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Session : 2024-25			
Part A - Introduction			
Subject	BOTANY		
Semester	4 th		
Name of the Course	Bioethics, Biosafety and IPR		
Course Code	24UN-BOT-405		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	DSE-1		
Level of the course (As per Annexure-I)	100-109		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Students will acquire a fundamental understanding of the basics of bioethics and biosafety. 2: Students will develop comprehensive knowledge about the ethical issues concerning biotechnology. 3: Students will gain knowledge about the safety of modified crops. 4: Students will develop a comprehensive understanding of the different forms of IPR. 5*. Students will gain the basic knowledge about the various tools and software used for the searching & formatting of scientific articles, plagiarism detection, plant breeders & farmers rights.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 70 Internal Assessment Marks: 20 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 30 Internal Assessment Marks: 10 End Term Exam Marks: 20		Time: 4 Hours	
Part B- Contents of the Course			
Instructions for Paper- Setter			
1. Nine questions will be set in all. All questions will carry equal marks. 2. Question No.1 will be short answer type covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.			
Unit	Topics	Contact Hours	
I	Ethical conflicts in biological sciences; bioethics in health care; artificial reproductive technologies; ethics in transplantation and stem cell research; biopiracy; biosafety levels.	11	
II	Ethical issues concerning biotechnology; primary containment for biohazards; recommended biosafety levels for specific microorganisms; biosafety guidelines for industrial operations with GMOs and field trial of GM crops.	11	

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III	Environmental risk assessment and food and feed safety assessment; balance of genetically altered and natural population in an ecosystem; safety of modified crops; social and economic effects.	12
IV	Different forms of IPR; patents, copyrights, designs, trademarks, geographical indication, trade secrets, semiconductor integrated circuit layout designs, plant breeders and farmers rights; general concept of patenting.	11
V*	• Plagiarism detection tools in scientific literature. • Case studies related to scientific article retraction. • Scientific article search tools; PubMed and Google scholar. • Formatting scientific literature; APA, AMA, MLA and NLM. • Case study: Protection of Plant Varieties and Farmers' Rights Act, 2001. • Case studies related to IPR.	30

Suggested Evaluation Methods

Internal Assessment: > Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: > Practicum • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc. • Mid-Term Exam:	End Term Examination:
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Part C-Learning Resources

• Sateesh, M.K. 2020. Bioethics and Biosafety. Wiley India. • Fleming, D.O. & Hunt, D. L. 2014. Biological Safety: Principles and Practices. ASM Press. 4th Edition. • Rathore, N.S. Mathur, S.M. Mathur, P. & Rathi, A. 2013. Intellectual Property Rights: Drafting, Interpretation of Patents Specification and claims. New India Publishing Agency-NIPA. • Parashar, S. & Goel, D. 2013. IPR, Biosafety and Bioethics. Pearson Education, India. • Poltorak, A.I. & Lerner, P.J. Wiley. 2011. Essentials of Intellectual Property: Law, Economics, and Strategy. John Wiley & Sons Inc. 2nd edition. • Rallapalli, R. & Bali, G. 2011. Bioethics & Biosafety. APH Publication Corporation. • Mephram, B. 2008. Bioethics: An introduction for the Biosciences. Oxford University Press. 2nd edition. • Thomas J.A., Fuch R.L. 2002. Biotechnology and Safety Assessment. Academic Press. 3rd Edition. • Cutter, S.I. 2003. Environmental Risks and Hazards. Publishers Prentice Hall. • Donnellan, C. 2002. Cloning. Independent Educational Publication.
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