

Scheme of Programme

Scheme UG A2: Bachelor of Science (Single Major)

Semester 1

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A1	Diversity of Microbes, Algae, Fungi and Archegoniates		3	-	2	3	-	1	4	25	50	5	20	100
CC-A2	Plant Propagation		3	-	2	3	-	1	4	25	50	5	20	100
CC-A3	Conservation Biology		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-1	One from Pool								2					50
Multidisciplinary Course(s)														
MDC-1	One from Pool								3					75
Ability Enhancement Course(s)														
AEC-1	One from Pool								2					50
Skill Enhancement Course(s)														
SEC-1	One from Pool								3					75
Value-added Course(s)														
VAC-1	One from Pool								2					50
Total Credits									24					600

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A4	Plant Taxonomy and Ecology		3	-	2	3	-	1	4	25	50	5	20	100
CC-A5	Plant Tissue Culture		3	-	2	3	-	1	4	25	50	5	20	100
CC-A6	Plant Molecular Biology		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-2	One from Pool								2					50
Multidisciplinary Course(s)														
MDC-2	One from Pool								3					75
Ability Enhancement Course(s)														
AEC-2	One from Pool								2					50
Skill Enhancement Course(s)														
SEC-2	One from Pool								3					75
Value-added Course(s)														
VAC-2	One from Pool								2					50
Total Credits									24					600

Semester 3

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A7	Plant Physiology		3	-	2	3	-	1	4	25	50	5	20	100
CC-A8	Bioethics, Biosafety and IPR		3	-	2	3	-	1	4	25	50	5	20	100
CC-A9	Plant Stress Physiology		2	-	2	2	-	1	3	15	35	5	20	75
Minor/ Vocational Course(s)														
MIC-3	One from Pool								4					100
Multidisciplinary Course(s)														
MDC-3	One from Pool								3					75
Ability Enhancement Course(s)														
AEC-3	One from Pool								2					50
Total Credits									20					500

Semester 4

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A10	Cytology and Genetics		3	-	2	3	-	1	4	25	50	5	20	100
CC-A11	Plant Breeding		3	-	2	3	-	1	4	25	50	5	20	100
CC-A12	Plant Pathology		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC/VOC-4	One from Pool								4					100
Ability Enhancement Course(s)														
AEC-4	One from Pool								2					50
Value-added Course(s)														
VAC-3	One from Pool								2					50
Total Credits									20					500

Semester 5

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A13	Economic Botany and Plant Biotechnology		3	-	2	3	-	1	4	25	50	5	20	100
CC-A14	Plant and Medicines		3	-	2	3	-	1	4	25	50	5	20	100
CC-A15	Plant Biochemistry and Metabolism		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-5	One from Pool								4					100
Skill Enhancement Course(s)														
Internship									4					100
Total Credits									20					500

Semester 6

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A16	Plant Anatomy and Embryology		3	-	2	3	-	1	4	25	50	5	20	100
CC-A17	Natural Plant Products		3	-	2	3	-	1	4	25	50	5	20	100
CC-A18	Reproduction in Higher Plants		2	-	2	2	-	1	3	15	35	5	20	75
Minor/ Vocational Course(s)														
MIC-6	One from Pool								4					100
MIC-7	One from Pool								4					100
Skill Enhancement Course(s)														
SEC-3	One from Pool								3					75
Total Credits									22					550

1. *The curriculum of semester 7 and 8 will be provided in due course of time.*

Syllabus UG A2: Single Major

Session: 2024-25			
Part A-Introduction			
Subject	BOTANY		
Semester	1 st		
Name of the Course	Diversity of Microbes, Algae, Fungi and Archegoniates		
Course Code	240/BOT/CC101		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A1		
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: <ol style="list-style-type: none"> 1. Students will be able to understand the general characteristics of bacteria, actinobacteria, viruses and fungi. 2. Students will develop a conceptual understanding of Phycology. 3: Students will gain knowledge on the concepts of Bryology. 3. Basic understanding of the biology of pteridophytes will be developed by the students. 4. Students will gain the knowledge of practical aspects of microorganisms, algae, fungi, lichens, bryophytes, and pteridophytes. 		
	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 75 Internal Assessment Marks: 25 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 25 Internal Assessment Marks: 5 End Term Exam Marks: 20		Time:4 Hours	
Part B-Contents of the Course			
Instructions for Paper-Setter			
<ol style="list-style-type: none"> 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	<p>Bacteria: Structure, nutrition, reproduction and economic importance.</p> <p>Viruses: General account of Viruse including structure of TMV and Bacteriophages.</p> <p>Algae: General characters, Introductory classification; economic importance; and life cycle (excluding development) of <i>Nostoc</i> (Cyanophyceae). <i>Volvox</i>, (Chlorophyceae), <i>Vaucheria</i> (Xanthophyceae), <i>Ectocarpus</i> (Phaeophyceae) and <i>Polysiphonia</i> (Rhodophyceae).</p> <p>Fungi: General characters, Introductory classification; economic importance; and life- history of <i>Phytophthora</i> (Mastigomycotina), <i>Penicillium</i> (Ascomycotina), <i>Puccinia</i> (Basidiomycotina), <i>Colletotrichum</i> (Deuteromycotina).</p>	11
II	<p>General account of Lichens, types, ecological and economic importance.</p> <p>Bryophyta: Bryophytes: General characteristics, classification upto classes (Smith, 1935), alternation of generations, structure and reproduction (excluding development) of <i>Marchantia</i> (Hepaticopsida), <i>Anthoceros</i> (Anthocerotopsida), <i>Funaria</i> (Bryopsida), ecological and economic importance of bryophytes.</p>	11
III	<p>Pteridophyta: General characters, classification upto classes (A. R. Smith, 2006), structure and reproduction (excluding development) of <i>Selaginella</i> (Lycopsida), <i>Equisetum</i> (Sphenopsida).</p>	11
IV	<p>Gymnosperms: General characteristics, classification up to classes (Smith1955), morphology, anatomy and reproduction of <i>Cycas</i>, <i>Pinus</i> (developmental details not to be included); Distribution and economic importance;</p>	12
V*	<p>Viruses: EMs/Models of viruses: TMV, Line drawing/Photograph of Lytic and Lysogenic Cycles.</p> <p>Bacteria: Types of Bacteria from temporary/permanent slides/photographs; Binary Fission; Conjugation; Structure of root nodule.</p> <p>Cynobacteria & Algae: Study of vegetative and reproductive structures of <i>Nostoc</i>, <i>Volvox</i>, <i>Vaucheria</i>, <i>Ectocarpus</i> and <i>Polysiphonia</i> through temporary preparations and permanent slides.</p> <p>Fungi: Study of vegetative & reproductive structures of <i>Phytophthora</i>, <i>Mucor</i>, <i>Puccinia</i>, <i>Penicillium</i> & <i>Colletotrichum</i>: Asexual and sexual stages through temporary preparations and permanent slides.</p> <p>Lichens: Study of slides/photographs of lichens (crustose, foliose and fruticose).</p> <p>Marchantia-Morphology of thallus, W.M. rhizoids and scales, V.S. thallus with gemma cup, W.M. gemmae, V.S. antheridiophore, archegoniophore, L.S. sporophyte (temporary/permanent slides).</p> <p>Anthoceros- Morphology of thallus, W.M. rhizoids, V.S. thallus, VS Antheridia and Archegonia, L.S. sporophyte (temporary/permanent slides).</p> <p>Funaria- Morphology, W.M. leaf, rhizoids, operculum, peristome, annulus, spores, slides showing antheridial and archegonial heads, L.S. capsule (temporary /permanent slides).</p> <p>Selaginella- Morphology, W.M. leaf with ligule, T.S.stem, W.M. strobilus, W.M. microsporophyll and megasporophyll, L.S. strobilus (temporary/permanent slide).</p> <p>Equisetum- Morphology, T.S. internode, L.S. strobilus, T.S. strobilus, W.M. sporangiophore, W.M. spores (wet and dry) (temporary slides); T.S. rhizome (permanent slide).</p> <p>Pteris- Morphology, T.S. rachis, V.S. sporophyll, W.M. sporangium, W.M. spores, T.S. rhizome, W.M. prothallus with sex organs and young sporophyte (temporary/permanent slide).</p>	30

Cycas- Morphology (coralloid roots, bulbil, leaf, megasporophyll), T.S. coralloid root, T.S. rachis, V.S. leaflet, V.S. microsporophyll, W.M. microspores, L.S. ovule, T.S. root (temporary/ permanent slide).

Pinus- Morphology (long and dwarf shoots, W.M. dwarf shoot, male cones and female cones), W.M. dwarf shoot, T.S. needle, T.S. stem, L.S./T.S. male cone, W.M. microsporophyll, W.M. microspores (temporary slides), L.S. female cone (temporary/ permanent slide).

Ephedra- Morphology, T.S. internode, L.S./T.S. male and female strobili, W.M. spores (wet and dry), T.S. rhizome (temporary/permanent slide).

Excursion Report: Report on excursion tours with photographs, collection and preservation specimens related to Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

Recommended Books/e-resources/LMS:

- Wiley, J.M., Sherwood, L.M. and Woolverton, C.J. (2019) Prescott's Microbiology. 11th Edition. McGraw Hill International.
- Lee, R.E. (2018) Phycology. 5th Edition. Cambridge University Press.
- Aluwalia, A.S. (2020). Phycology: Principles, Processes and Applications. Daya Publishing House, New Delhi.
- Dube, H.C. (2012). An Introduction to Fungi, Vikas Publishing House Pvt. Ltd., Delhi. 4th edition.
- Mehrotra, R.S. and Aggarwal, Ashok (2013) Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing company Ltd, New Delhi.
- Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
- Sethi, I.K. and Walia, S.K. (2011). Textbook of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
- Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi, India.
- Sharma, O.P. (2017). Text Book of Pteridophyta, McMillan India Ltd.
- Thakur, A.K. and Bassi, S.K. (2008). Diversity of Microbes and Cryptogams. S. Chand & Co., Delhi.
- Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

Session:2024-25			
Part A–Introduction			
Subject	BOTANY		
Semester	1st		
Name of the Course	Plant Propagation		
Course Code	240/BOT/CC102		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A2		
Level of the course (As per Annexure-I)			
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Students will acquire knowledge regarding the fundamental aspects of plant propagation. 2. Students will develop a conceptual understanding of seed propagation. 3. Students will gain knowledge about vegetative propagation methods. 4. Students will acquire a conceptual understanding of cell and tissue propagation techniques. 5. Students will be able to demonstrate the basic principles and practical consideration of in vitro plant cell/tissue culture, plant propagation methods, sterilization methods, tools and techniques. 		
	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 75 Internal Assessment Marks: 25 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 25 Internal Assessment Marks: 5 End Term Exam Marks: 20		Time: 4 Hours	
Part B-Contents of the Course			
Instructions for Paper-Setter			
<ol style="list-style-type: none"> 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	General aspects of plant propagation: Evolution of plant propagation techniques; Biology of plant propagation: impact of genes; Effect of environment on propagation: Greenhouse systems, environmental control	11
II	Seed propagation: Seed development, principles and practices of seed selection, techniques of seed production and handling, principles and techniques of seed propagation.	11
III	Vegetative propagation: Principles and Practices of Clonal Selection; Principles and techniques of propagation by cuttings; Principles and techniques of Grafting and Budding; Layering and Its Natural Modifications; Propagation by Specialized Stems and Roots	12
IV	Cell and Tissue propagation: Principles and Techniques of Micropropagation from Meristematic Tissue; Principles and Techniques of Plant Tissue Culture from Non-meristematic Tissue.	11
V*	<ul style="list-style-type: none"> • Study of tools used in plant propagation. • Cutting techniques of selected plants: hardwood cuttings, softwood cuttings, greenwood cuttings, semi-ripe cuttings, root cuttings and leaf cuttings. • Layering and air-layering in selected plants. • Grafting and division. • Micropropagation: Sterilization of explants, dissection of meristematic regions, media preparation and explant proliferation. • Preparation of compost/growing media. • Hardening and after care of propagated plants. 	30

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Razdan, M.K. 2019. Introduction To Plant Tissue Culture. OXFORD & IBH Publishing.3rd edition.
- Loyola-Vargas,V.M. & Ochoa-Alejo, N. 2018. Plant cell culture protocols. Human a Press.4thedition.
- 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.
- Dirr, M.A. & Heuser,Jr.C.W. 2006. The Reference Manual of Woody Plant Propagation From Seed to Tissue Culture. Timber Press, Inc. Portland, OR. 2nd edition.

Session: 2024-25**Part A–Introduction**

Subject	BOTANY		
Semester	1st		
Name of the Course	Conservation Biology		
Course Code	240/BOT/CC103		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A3		
Level of the course (As per Annexure-I)	100-109		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <p>1: Students will comprehend the fundamental principles of biodiversity.</p> <p>2: Students will acquire a conceptual understanding of the classifications used by the IUCN.</p> <p>3: Students will acquire knowledge about the principles of conservation laws and international legislation.</p> <p>4: Students will develop a foundational understanding of international legislation.</p> <p>5: Student will learn about the practical approaches to protect and restore the biological communities.</p>		
	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 75 Internal Assessment Marks: 25 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 25 Internal Assessment Marks:5 End Term Exam Marks: 20		Time:4 Hours	
Part B-Contents of the Course			
Instructions for Paper-Setter			
<p>1. Nine questions will be set in all. All questions will carry equal marks.</p> <p>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.</p>			
Unit	Topics		Contact Hours

I	Biodiversity: Types of Biodiversity; Level of Biodiversity: genetic, species and ecosystem; Patterns of biodiversity; Factors affecting biodiversity: over exploitation, habitat loss and degradation, invasive species, disease, natural calamities, global change. Concept of endemism in plants, endemic plants of Western Ghats.	11
II	IUCN categories: not evaluated; data deficient; least concern; near threatened, vulnerable, endangered, critically endangered, extinct in wild; extinct categories. Principles of conservation; in situ and ex situ conservation; Economics of conservation	11
III	Conservation laws and international legislation. Soil erosion and conservation methods. Conservation of Forests: Afforestation, Reforestation, Monoculture and their effects. Conservation of water: water scarcity, rain water harvesting, watershed management. World Biodiversity hotspots; Wetlands.	11
IV	Categories of Protected areas: IA Strict Nature reserves, IB Wilderness area; II National Park; III Natural monument or feature; IV Habitat or species management area; V Protected landscape/seascape; VI Protected area with sustainable use of natural resources, Sustainable development goals. Recent conservation approaches in India.	12
V*	<ul style="list-style-type: none"> • To determine the Calcium content of soil samples using titration method. • To estimate available N₂ in a given soil sample. • To determine the role of CO₂ evolution from the given soil sample. • To calculate their phosphorous content of the given soil sample. • To interpret the Annual Forest report with reference to Haryana. • To study the Biosphere reserves of India-National park, wildlife sanctuaries in Haryana. 	30

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Wetlands Through Time By Stephen F. Greb, William A. DiMichele Published by Geological Society of America, 2006
- Introduction to Conservation Genetics: Richard Frankham, Jonathan D. Ballou and David A. Briscoe By Richard Frankham, David Anthony Briscoe, Jonathan D. Ballou, Karina H. Cambridge University Press, 2012
- Plant Conservation Genetics By Robert J. Henry Published by Cambridge University Press, 2012.
- Wetlands By William J. Mitsch, James G. Gosselink Published by John Wiley and Sons, 2007.
- Hunter Jr., M. L. Fundamentals of Conservation Biology. Blackwell Science, Malden, Massachusetts, U.S.A 2021.
- Red Data Books Vols.1 to 4. Botanical Survey of India, Dehradun
- Benson EE. Plant Conservation Biotechnology. Agrosciences, New Delhi, 2014.

Syllabus UG A2: Single Major

Session:2024-25	
Part A-Introduction	
Subject	BOTANY
Semester	2nd
Name of the Course	Plant Taxonomy and Ecology
Course Code	240/BOT/CC201
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A4
Level of the course (As per Annexure-I)	

Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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 gain knowledge about Ecology and Environmental interactions. 4. Students will acquire a conceptual understanding of ecosystem structure, environmental pollution and biodiversity conservation. 5. Students will gain the knowledge about the diagnostic features, morphology, internal structure, economic value of angiosperms and ecological concepts and biodiversity indices. 		
	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 75 Internal Assessment Marks: 25 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 25 Internal Assessment Marks:5 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 and ICN; Keys to identification of plants. General introduction and importance of herbaria and botanical gardens. Documentation of Floristic Diversity: Brief idea about floras, monographs and journals. Brief idea of taxonomic evidences. Types of inflorescence, flower and parts of flower.	11
II	Artificial, natural and phylogenetic classifications. Bentham and Hooker system of classification (upto series), Angiosperm Phylogeny Group- general account. Diagnostic features and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Euphorbiaceae, Rutaceae, Leguminosae, Apocynaceae, Lamiaceae, Solanaceae, Asteraceae, Poaceae and Orchidaceae.	12
III	Ecology: Definition; scope and importance; levels of organization. Environmental factors- climatic factors, edaphic factors, topographic; and Biotic factors. Population Ecology: Basic concept; characteristics; biotic potential, growth curves; ecotypes and ecads. Community Ecology: Concepts; characteristics (qualitative and quantitative-analytical and synthetic); methods of analysis; ecological succession.	11
IV	Ecosystem: Structure and functions (trophic levels, food chains, food webs, ecological pyramids and energy flow). Phyto-geography: Phyto-geographical regions of India; vegetation types of India (forests). Environmental Pollution: Sources, types and control of air and water pollution. Global Change: Greenhouse effect and greenhouse gases; impacts of global warming; carbon trading. Biodiversity: levels, types, significance, threats and conservation.	11

V*	<ul style="list-style-type: none"> • Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. • Determination of pH, and analysis of two soil samples for carbonates, chlorides and sulphates by rapid field test. • Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats. • To determine inorganic carbon content of given soil samples. • To determine organic carbon content of given soil samples by acid dilution method. <p>(a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b) Study of biotic interactions of the following: Stem parasite (<i>Cuscuta</i>), Root parasite (<i>Orobanch</i>), Epiphytes (Orchid) and Predation (Insectivorous plants) using museum specimens/ live plants.</p> <ul style="list-style-type: none"> • Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus or nearby fields by species area curve method (species to be listed). • Quantitative analysis of herbaceous vegetation in the college campus or nearby fields for frequency and comparison with Raunkiaer's frequency distribution law. • Study of vegetative and floral characters of the one or two member of each family/sub-family mentioned in theory syllabus (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification). • Excursion Report: Report on excursion tours with photographs, collection, preservation and preparation of herbarium sheets and specimens related to Angiosperms. Mounting of a collected, properly dried and pressed specimen of minimum 20 wild plants with herbarium label. 	30
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Singh, G. (2021). Plant Systematics: An Integrated Approach, CRC Press.
- Sharma, O.P. (2017). Plant Taxonomy, McGraw Hill Publication.
- Levetin, E. & McMahon, K. 2015. Plants and Society, McGraw-Hill Education.7th edition.
- Smith, T.M. & Smith, R.L.2014.Elements of Ecology. Pearson.9th edition.
- Gangulee, Dasand Datta (2011).College Botany Volume 1, New Central Book Agency
- Gangulee, Dasand Datta (2011). College Botany Volume 2, New Central Book Agency
- Vashishta, P.C., Sinha, A.K., Kumar, A.,(2010).Gymnosperms, S. Chand.
- Taylor, E.L., Taylor, T.N., Krings, M. (2009). Paleobotany: The Biology and Evolution of Fossil Plants, Academic Press.
- Pandey, B.P. (2001). A Text book of Botany-Angiosperms, S. Chand.
- Pandey, B.P. (2001). A Text book of Botany-Angiosperms, S. Chand.
- Chapman, J.L. & Reiss, M.J. 1999. Ecology: Principles and Applications. Cambridge University Press.

- Odum E.P. (1971): Fundamentals of Ecology 3rd edition. Saunders College Publishing/Harcourt Brace.

Session: 2024-25			
Part A-Introduction			
Subject	BOTANY		
Semester	2nd		
Name of the Course	Plant Tissue Culture		
Course Code	240/BOT/CC202		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A5		
Level of the course (As per Annexure-I)			
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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. 		
	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 75 Internal Assessment Marks: 25 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 25 Internal Assessment Marks: 5 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: Historical perspective; Aseptic tissue culture techniques, Totipotency; Differentiation and dedifferentiation. Methodology: Sterilization (physical and chemical methods), Composition of media; Nutrient and hormone requirements (role of vitamins and hormones), medium for micro propagation/clonal propagation of ornamental and medicinal plants. Tissue culture applications (micro propagation, and oogenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).	11
II	Callus subculture maintenance, growth measurements, morphogenesis in callus cultures: Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Anther culture, Embryo culture, Endosperm culture, Embryo rescue technique. Artificial seed production. Hardening and Acclimatization.	11
III	Recombinant DNA technology-I: Restriction Endonucleases (role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic and Eukaryotic. Gene Cloning (Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR-mediated gene cloning). Recombinant DNA technology-II: Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain genes of interest by genetic selection; complementation, colony hybridization.	12
IV	Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment; Selection of transgenic-selectable marker and reporter genes (Luciferase, GUS, GFP). Transgenic plants: Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moon dust carnations); Role of transgenic in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillus, Protease, Lipase); Genetically Engineered Products–Human Growth Hormone; Hamblin; Biosafety concerns.	11
V*	<ul style="list-style-type: none"> • 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, Datura, Brassica etc. • Study of anther, embryo and endosperm culture, micro propagation, somatic embryogenesis & artificial seeds. • Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, micro projectile bombardment. • Study of steps of genetic engineering for production of Bt cotton, Golden rice, FlavrSavr tomato through photographs. • Isolation and quantification of genomic DNA from bacteria (E. coli) or Plants • Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, 	30

DNA sequencing, PCR through photographs.

- Production of wine from the fruit juice of grapes by fermentation process using yeast

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.
- Glick, B.R., Pasternak, J.J. & Patten C.L. 2010. Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington. 4th 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.

Session:2024-25			
Part A-Introduction			
Subject	BOTANY		
Semester	2nd		
Name of the Course	Plant Molecular Biology		
Course Code	240/BOT/CC203		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A6		
Level of the course (As per Annexure-I)			
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 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. 		
	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
THEORY			
Max. Marks: 75 Internal Assessment Marks: 25 End Term Exam Marks: 50		Time: 3 Hours	
PRACTICAL			
Max. Marks: 25 Internal Assessment Marks: 5 End Term Exam Marks: 20		Time: 4 Hours	
Part B-Contents of the Course			
Instructions for Paper-Setter			
<ol style="list-style-type: none"> 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	Nucleic acids: Carriers of genetic information: Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty), Types of genetic material, denaturation and renaturation, Nucleosome. DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons)	11
II	RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).	11
III	Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins).	12
IV	Control of gene expression at transcription and translation level (regulating the expression of prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).	11
V*	<ul style="list-style-type: none"> • Preparation of LB medium and raising E.coli. • Isolation of genomic DNA from E.coli./onion roots • RNA estimation by orcinol method. • DNA estimation by diphenylamine reagent/UV Spectrophotometry. • Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, • Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments) • Study of Barr body from buccal smear preparation. 	30

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. TheWorldof 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.
- DeRobertis, E.D.P. and DeRobertis, 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.

