

M.Phil., Botany

SEM	COURSE CODE	COURSE	COURSE TITLE	HRS / WEEK	CREDIT	CIA Mark	ESE MARK	TOTAL MARK	
I	20MPBO1CC1	CORE-I	Research Methodology	4*	4	25	75	100	
	20MPBO1CC2	CORE-II	Recent Advances in Plant Science	4*	4	25	75	100	
	20MPBO1CC3	CORE-III	Teaching And Learning Skills	4*	4	25	75	100	
	20MPBO1CC4	CORE-IV (Elective)	Paper on Topic of Research (The syllabus will be prepared by the guide and examination will be conducted by the COE)	4*	4	25	75	100	
		*One-hour library for each course							
		TOTAL			16*	16	100	300	400
II	20MPBO2PD		Dissertation##	-	8	-	-	200	
GRAND TOTAL				-	24	-	-	600	

##Evaluation of the Dissertation and Viva Voce shall be made jointly by the Research Supervisor and the External Examiner.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC1	Core – I	Research Methodology	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Describe the working principles, components, staining techniques of tissues and application of microscopes.
2. Appraise theoretical aspects of important analytical techniques and instruments used in life science.
3. Design the suitable separation techniques to characterize the functional biomolecules.
4. Choose the correct approach to process and analyze the data.
5. Conclude the research by using primary and secondary data and document the same.

Unit I: Microscopic techniques

12 Hours

Microscopy – Principle and applications of bright field, dark field, phase contrast, fluorescent microscopy, Electron Microscopy (SEM & TEM) and Confocal microscopy. Staining techniques – simple stain, negative stain, #Gram stain# and acid-fast stain. Freeze-etch and freeze fracture methods for EM, image processing methods in microscopy.

Unit II: Analytical methods

12 Hours

Electrochemical techniques: Principles, measurement of pH and types of electrodes. #Preparation of biological buffers#. Spectroscopic techniques: Principle, types and application. UV and Visible, Infrared, Fluorescence and Raman spectroscopy. Nuclear magnetic resonance, Electron spin resonance, Surface Plasmon resonance and Atomic absorption spectroscopy. Radio labeling techniques: Properties of different types of radioisotopes, detection, measurements of radioactivity and applications. Geiger Muller and scintillation counter and autoradiography.

Unit III: Separation techniques

12 Hours

Chromatography: Principle, types and applications (#Paper, Thin layer#, Column, HPLC, HPTLC, UHPLC, GC and LC-MS). Centrifugation: Principles, types, different types of rotors and applications. Molecular techniques: DNA and RNA isolation and purification. Polymerase Chain Reaction (PCR) and its types. Electrophoretic techniques: Principles, types and applications (Agarose gel, SDS-PAGE, 2D and 3D gel electrophoresis). Blotting techniques (Southern, Northern and Western blotting).

Unit IV: Statistical methods

12 Hours

Population and sample – data collection, sampling methods and #diagrammatic representation of data#. Measures of central tendency (mean, median and mode). Measures of dispersion (range and standard deviation). Correlation and regression analysis. Probability distributions: binomial, Poisson and normal. Types of error. Statistical inference: F-test, t-test and chi-square test. Analysis of variance (one way and two-way), Duncan multiple ranges test and multi variant analysis. Discriminate analysis using SPSS and SAS software's.

Unit V: Documentation of Research

12 Hours

Research, meaning, objective, types (qualitative, quantitative and applied research). Role of a researcher, supervisor/guides. Research problem, design, sample survey, measurement and scaling, data collection and preparation. Literature and reference collection. #Role of libraries and internet in research#. Browsing tools, virtual libraries, e-journals and e-books. Interpretation and report writing (Grammarly software). Components of dissertation and thesis writing. Preparation of short communication, research and review articles. Endnote and Mendeley software in Bibliography preparation. Plagiarism and Research ethics.

#.....# Self Study portion

Text Books:

1. Bajpai PK, Biological Instrumentation and Methodology, Revised Edition, Chand S & Company PvtLtd, New Delhi, India, 2010.
2. Mustafa A, Research Methodology, 1st Edition, AITBS Publishers, New Delhi, India, 2010.
3. Kothari CR and Garg G. Research Methodology Methods and Techniques. 4th Edition. New Age International Publishers PvtLtd, New Delhi, India, 2019.

Books for Reference:

1. Gurumani N, Research Methodology for Biological Sciences, Revised Edition, MJP PublishersPvt Ltd, Chennai, India, 2011.
2. Shefali P. Research Methodology. 1st Edition. APH Publishing CorporationPvt Ltd, New Delhi, India, 2017.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
I	20MPBO1CC1	Research Methodology					4	4		
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓			✓	✓	✓		
CO2	✓		✓			✓		✓		✓
CO3	✓		✓			✓		✓		✓
CO4	✓			✓	✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches = 31, Relationship: Moderate										

Prepared by:

1. Dr. H. Syed Jahangir

Checked by:

1. Dr. A. Asalam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. Marks	Internal marks	External marks
I	20MPBO1CC2	Core – II	Recent Advances in Plant Science	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Recognize the importance of molecular markers in modern taxonomy.
2. Explain the different applications of proteomics and genomics.
3. Outline the significance of plant tissue culture and genetic engineering.
4. Formulate biological mediated nano-materials for pharmaceutical applications.
5. Review the recent consents of plant biodiversity and climate change.

Unit I: Plant Biodiversity and climate change

12 Hours

Biodiversity: Endemism, variation, biodiversity hotspots, biodiversity indicators, biodiversity conservation, invasive alien species –#Activities of IUCN, NBPGR, national biodiversity authority (NBA) and Centre for biological diversity#. Anthropogenic impact on ecosystems and climate change; ozone depletion, global warming, carbon budgeting, trading and sequestration.

Unit II: Molecular taxonomy

12 Hours

Molecular markers – Random Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP), Internal transcribed spacer (ITS), Inter Simple Sequence Repeats (ISSR), Simple Sequence Repeats (SSR). #DNA barcoding#, chloroplast markers – matK, ndhF, rbcL, trnH-psbA, SCAR (Sequence Characterized Amplified Region), SSCP (Single-Strand Conformation Polymorphism) and its applications. Molecular systematics.

Unit III: Plant genomics and proteomics

12 Hours

Genomics: Whole genome sequencing and functional genomics. Proteomics: Protein engineering – Achievements and prospects. *Arabidopsis thaliana* and rice genome projects and their importance. #Chloroplast and mitochondrial structure# and genome organization. Brief account on transcriptomics.

Unit IV: Plant tissue culture and genetic engineering

12 Hours

Secondary metabolites production through *in vitro* culture. #Biofermenters – Types, designs#, industrial scaling, upstream and down-stream processing. Direct and indirect gene transformation technology. Transgenic plants – viral, fungal, bacterial, pest and herbicidal resistant. Food vaccines, bioplastics, plantibodies and plantigens. Brief account on molecular farming.

Unit V: Nano-biotechnology

12 Hours

Nanoparticles – Definition and historical background. Principles and properties of nanoparticles and nanomaterials. Biological synthesis, biomimetics, microbial nanoparticle production, magnetosomes, bacteriorhodopsins. Nanoproteomics – role of biomolecules, reducing or capping agents, proteins, carbohydrates and viruses. #Nanomaterials and their applications#.

#.....# Self-Study portion

Text Books:

1. Krishnamoorthy KV, An Advanced Text Book on Biodiversity, Oxford and IBH Book House Pvt Ltd, New Delhi, India, 2003.
2. Govil CM, Aggarwal A and Sharma J, Plant Biotechnology and Genetic Engineering, PHI Learning Pvt Ltd, New Delhi, India, 2017.
3. Suresh Kumar G, Raj Kumar S, Priyanka S, Joginder Singh D and Pawan K, Plant Biotechnology: Recent Advancements and Developments, Springer, 2017.

Book for Reference:

1. Murty BS, Shankar P, Raj B, Rath BB and Murday J, Textbook of Nanoscience and Nanotechnology, Springer, 2013.
2. Anis M and Ahmad N. Plant Tissue Culture: Propagation, Conservation and Crop Improvement, Springer, 2016.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
I	20MPBO1CC2	Recent Advances in Plant Science					4	4		
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓	✓				✓
CO2	✓	✓			✓	✓				✓
CO3	✓	✓	✓	✓	✓	✓				✓
CO4	✓	✓	✓	✓	✓	✓				✓
CO5	✓	✓	✓	✓	✓	✓				✓
Number of Matches = 31, Relationship: Moderate										

Prepared by:

1. Dr. A. Shajahan

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC3	Core – III	Teaching and Learning Skills	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Practice teaching and learning pedagogy.
2. Design modern teaching methods.
3. Appraise methods and materials used in curative teaching.
4. Construct new class room management techniques.
5. Support the process of guidance and counseling through recent research information.

Unit I: Higher education

12 Hours

Historical perspective, objectives and role of higher education, social, curricular and administrative focus. Need for teaching methodology, learning and teaching. Learning – definition, hierarchy, #events and outcomes#.

Unit II: Teaching technology designs

12 Hours

Teaching technology – Instructional and education technology. Instructional designs – objective, skill, competency, learning style and model based. Combination of teaching strategies and instructional designs. Psycho dynamics of #group learning, lecture method#, modified forms of lecture, seminar, symposium and team teaching.

Unit III: Class room management

12 Hours

Teacher and class room management – A conceptual analysis, discipline, class room management, strategies for class room management, behaviour problems of students in colleges and #human relations in educational institutions#.

Unit IV: Remedial teaching

12 Hours

Remedial teaching – diagnosis, principles of diagnosis, steps in diagnosis and reading. Remedial education in reading – causes of reading disability, reading programmes, development of reading programme, corrective, remedial instruction and #remedial teaching for academic low achievers#.

Unit V: Guidance and counselling in higher education

12 Hours

Meaning and scope of guidance, principles of guidance, counselling, vocational guidance. Professional growth – Need and importance of professional growth and #professional ethics#.

#.....# **Self-Study portion**

Text Books:

1. Vedanayagam EG, Teaching Technology for College Teachers. Revised Edition, Sterling Publishers Pvt Ltd, Chennai, India, 1988.
2. Aggarwal JC, Principles, Methods & Techniques of Teaching, 2nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2009.
3. Mangal SK and Uma M, Essential of Educational Technology, 1st Edition, Prentice Hall India Learning Pvt Ltd, New Delhi, India, 2009

Books for Reference:

1. Aggarwal JC, Development and Planning of Modern Education, 9th Edition, Vikas Publishing House Pvt Ltd, New Delhi, India, 2009.
2. Mohamed M, Learning Skills at the University, 1st Edition, Lambert Academic Publishing Pvt Ltd, Germany, 2013.

Semester	Code	Title of the Paper					Hours	Credits		
I	20MPBO1CC3	Teaching and Learning Skills					4	4		
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓			✓		✓		✓	✓
CO2	✓	✓			✓		✓		✓	✓
CO3		✓		✓	✓		✓		✓	✓
CO4	✓	✓		✓	✓		✓		✓	✓
CO5		✓		✓	✓		✓		✓	✓
Number of Matches = 30, Relationship: Moderate										

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Prepared by:

1. Dr. R. Ravikumar

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Ethnobotany and Sacred Groves	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Describe the significance of ethnobotany.
2. Apply various ethnopharmacological skills.
3. Analyze and preserve Traditional Knowledge.
4. Know major and minor ethnic group and their life style.
5. Recognize threats and conservation of sacred grooves.

Unit I: Ethnobiology

12 Hours

Ethnobotany definition, terminologies, Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. Significance of the common plants in ethno botanical practices. Relevance of ethnobotany in the present context.

Unit II: Ethnopharmacology

12 Hours

Traditional Systems of Medicine: Brief history of use of medicinal herbs; Introduction to indigenous systems of medicines-Ayurveda, Unani and Siddha system of medicine. Role of ethnobotany in modern Medicine.

Unit III: Methodology of Ethnobotanical Studies

12 Hours

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places. Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge, TKDL .

Unit IV: Ethnoecology and Sacred Groves

12 Hours

Major and minor ethnic groups or Tribal of India, and their life styles. Role of ethnic groups in conservation of plant genetic resources. Participatory forest Management – Sacred Groves – Definition, Concepts, beliefs, Sthalvirshas. Plants used: Ecosystem Service Provisioning Services Regulating Services Supporting Services Cultural and Amenity services.

Unit V: Sacred Groves and Conservation

12 Hours

Sacred groves in India, Names of Sacred groves in Indian States, Sacred Groves in Eastern, Western Ghats and in Plains. Major Threats to the Sacred Groves Conservation of Sacred Groves the Sacred Groves and Their Significance in Conserving Biodiversity.

#.....# Self-Study portion

Text Books:

1. Ghoush AK, Ethnobiology: Therapeutics and Natural Resources, 1st Edition, Daya Publishing House, New Delhi, India, 2009.
2. Jain AK, Indian Ethnobotany: Emerging Trends, 1st Edition, Scientific Publishers Pvt Ltd, New Delhi, India, 2016.
3. Pullaiah T, Krishnamurthy KV and Bahadur B, Ethnobotany of India, 1st Edition, CRC press, Taylor and Francis Group, 2017.

Books for Reference:

1. AmrithalingamM, Sacred Trees of Tamil Nadu, 1st Edition, CPREnvironmental Education Centre, Chennai, Tamil Nadu, India, 1998.
2. Sacred Groves of India: An Annotatedbibliography http://www.ces.iisc.ernet.in/biodiversity/sahyadri_enevs/newsletter/issue4/Yogesh_Anno_bib.pdf

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20MPBO1CC4	Ethnobotany and Sacred Groves					4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓				✓		✓				
CO2	✓	✓		✓	✓	✓				✓	
CO3	✓	✓	✓			✓	✓	✓	✓	✓	
CO4	✓		✓	✓	✓	✓		✓	✓	✓	
CO5	✓		✓	✓	✓	✓		✓	✓	✓	
Number of Matches= 33, Relationship: Moderate											

Prepared by:

1. Dr. M. Ghouse Basha

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Applied Microbiology	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Outline the facets of microbiology.
2. Apply various lab skills for economic use of microbes.
3. Analyze novel ideas of using microbes in human life.
4. Develop alternative applications of microbes to solve human health related problems.
5. Conceive opportunities of jobs and entrepreneurship in microbiology.

Unit I: Microbial Genetics

12 Hours

Mendel's laws of inheritance; genetic notations; Transfer of genetic material in prokaryotes; Transformation; competence, mechanism of transformation, transfection; Conjugation; role of surface properties in conjugation; The F- factor; The conjugal transfer process; Barriers to conjugation; High frequency recombination (Hfr) strains; The order of chromosome transfer and conjugation mapping, high resolution mapping; Formation of F primer (F); #Transduction; Generalized transduction; Abortive transduction; specialized transduction (LFT lysate and HFT lysate)#.

Unit II: Industrial Microbiology

12 Hours

Fermentation and fermentable microbes; Basic function of fermenters; Types of fermenter (Fluidized bed bioreactor; membrane bioreactor; pulsed column bioreactor; photobioreactor; packed tower bioreactor); construction of fermenters (control of temperatures, aeration and agitation); Design and operation; The achievement and maintenance of aseptic condition (sterilization, aeration and agitation); Aseptic operation and contaminant; Batch fermentation, Fed-batch fermentation, continuous fermentation, scale up of fermentation (sterilization of gases and nutrient solutions, stock cultures), #Fermentation; Malt beverages; Production of Beer; Production of Wine Microbial production of organic acids; vinegar production (substrate method)#.

Unit III: Environmental Microbiology

12 Hours

Waste as a resource; Organic compost (Definition, process of composting – microorganisms, soil and organic matter, Role of compost), Vermi-composting – process of vermin composting Biogas (Benefits from biogas plants, Feed stock materials, Biogas production; solubilization, acetogenesis and methanogenesis), Microbial leaching #Uranium leaching; microbial degradation of xenobiotics; characteristics of microbial metabolism (enzymatic process, non-enzymatic process), common process of insecticidal metabolism (hydrolytic process, reductive process, oxidation)#.

Unit IV: Food Microbiology and Public Health

12 Hours

Food hazards; significance of Foodborne disease, Incidence of Foodborne Illness, Risk Factors Associated with Foodborne Illness, The site of Foodborne Illness. #The Alimentary tract; its Function and Microflora. The pathogenesis of diarrheal disease#.

Unit V: Pharmaceutical Microbiology

12 Hours

Good Manufacturing Practice (GMP); Good laboratory practice (GLP); Quality control (QC); Quality Assurance (QA); Sterile clean Area (SAC); Environmental Monitoring (LM); Sterilization; Disinfectants and Antiseptics; Sterility test; #Antibiotic assay; Microbial Limit Test (MLT); Pyrogen (Endotoxin), Preservative Efficacy test#.

#.....# **Self-Study portion**

Text Books:

1. Trivedi PC, Applied Microbiology, 2nd Edition, Agrobios Publishers Pvt Ltd, Rajasthan, India, 2006.
2. Purohit SS, Microbiology Fundamentals and Applications, 7th Edition, Agrobios Publishers Pvt Ltd, Rajasthan, India, 2008.
3. Casida LEJR, Industrial Microbiology, 2nd Edition, New Age International Publishers Pvt Ltd, New Delhi, India, 2019.

Books for Reference:

3. Anathanarayan R and Jayaram Paniker CK, Text Book of Microbiology, 10th Edition, Universities Press (India) Pvt Ltd, New Delhi, India, 2017.
4. Willey JM, Sherwood LM and Woolverton CJ, Prescott's Microbiology, 10th Edition, McGraw Hill Education Pvt Ltd, New York, 2017.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20MPBO1CC4	Applied Microbiology					4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓				✓	✓				✓	
CO2	✓			✓	✓	✓				✓	
CO3	✓		✓	✓	✓	✓		✓	✓	✓	
CO4	✓		✓	✓	✓	✓		✓	✓	✓	
CO5	✓		✓	✓	✓	✓		✓	✓	✓	
Number of Matches= 33, Relationship: Moderate											

Prepared by:

1. Dr. H. Syed Jahangir

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Conservation of Biodiversity	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Evaluate the basic concepts of biodiversity.
2. Analyze the societal importance of biodiversity and its loss.
3. Analyze the importance of conserving natural resource.
4. Outline the facets of *ex situ* conservation for human welfare.
5. Demonstrate the social and ethical values of sacred groves.

Unit I: Basic concepts and values of biodiversity

12Hours

Biodiversity basic concepts – genetic diversity – #species diversity# - economic diversity – scopes – value of biodiversity.

Unit II: Loss of Biodiversity

12Hours

Loss of genetic diversity loss of species diversity – threatened species – threatened categories loss of economic diversity – #Red Data Book#.

Unit III: *In situ* conservation of biodiversity

12Hours

Protected areas – Biosphere reserves National parks – World Biosphere – Reserves programmes – Design of biosphere reserves – Biological aspects of reserves design – Vest pockets and Garrison reserves – #On farm and garden conservation#.

Unit IV: *Ex situ* conservation of biodiversity

12Hours

Germplasm collection – botanical garden – seed bank – test tube gene banks – pollen bank – field gene bank – #DNA bank# – important of plant tissue culture in conservation of plant diversity.

Unit V: Social approaches of biodiversity conservation

12Hours

Sacred groves – chipko movement – chipko river dam – #tribal campaign#– participatory forest management – role of education institution in biodiversity conservation.

#.....# **Self-Study portion**

Text Books:

1. Prithipalsingh, An Introduction to biodiversity, 1st Edition, ANE Books Pvt Ltd, New Delhi, India, 2009.
2. Mahanty S and Anjali S, Biodiversity and its conservation, 1st Edition, Disha International Publishing House Pvt Ltd, New Delhi, India, 2016.
3. Krihnamoorthy KV, An Advanced Textbook on Biodiversity: Principles and Practice, 2nd Edition, Oxford & IBH Publishing House Pvt Ltd, New Delhi, India, 2018.

Books for Reference:

1. Joshi PC, Biodiversity and Conservation, 1st Edition, APH Publishing House Pvt Ltd, New Delhi, India, 2004.
2. Fitzgerald J, Biodiversity: An Introduction, 1st Edition, Larsen and Keller Education Pvt Ltd, Auckland, 2017.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20MPBO1CC4	Conservation of Biodiversity					4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓		✓			✓	✓	
CO2	✓		✓	✓	✓	✓			✓	✓	
CO3	✓			✓	✓	✓			✓	✓	
CO4	✓			✓	✓	✓			✓	✓	
CO5	✓			✓	✓	✓			✓	✓	
Number of Matches = 31, Relationship: Moderate											

Prepared by:

1. Dr. A. SHAJAHAN

Checked by:

1. Dr. A. ASLAM

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Herbal Botany	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Recognize the facets of herbal botany.
2. Summarize the collection of herbal products.
3. Develop methods to process crude drugs.
4. Enumerate the types of phytochemical drugs.
5. Justify the use of phytochemical compounds for human welfare.

Unit I: Pharmacognosy

12Hours

Herbal medicines: History and scope – Indian system of medicines – siddha, ayurveda and unani.
#Classification of Crude drugs#.

Unit II: Collection and processing of herbal drugs

12Hours

Collection – harvesting – processing (drying, dressing, packing, storage and preservation) – cultivation of medicinal plants and #aromatic plants in India#.

Unit III: Collection of crude drugs

12Hours

Collection of crude drugs – harvesting of crude drugs – drying of crude drugs (natural drying and artificial drying) – garbling – packing of crude drugs – storage of crude drug, marketing and #drug adulteration#.

Unit IV: Phytochemical compounds

12Hours

Drugs obtained from leaves – *Gymnemasylvestre*, *Ocimum sanctum*. Drugs Obtained from Flower – *Syzygiumaromaticum*. Drugs from fruits – #*Coriandrumsativum*#.

Unit V: Phytochemical compounds

12Hours

Brief description, bioactive compounds and medicinal uses of Aloe (glycosides) – Amla (tannins) – Black pepper(terpenoids) – Ginger (resin) – #*Vinca* (alkaloids)#.

#.....# Self-Study portion

Text Books:

1. Kumar GS and Jayaveera KN, A Textbook of Pharmacognosy and Phytochemistry, 1st Edition, Chand & Company Pvt Ltd, New Delhi, India, 2014.
2. Prajapati, Purohit, Sharma, Kumar, A Handbook of Medicinal Plants, 1st Edition, Agrobios Publishers Pvt Ltd, Rajasthan, India, 2018.
3. Roseline A, Pharmacognosy, 1st Edition, MJB Publishers, Chennai, Tamil Nadu, India, 2019.

Books for Reference:

1. Gokhale SB, Kokate CK and Purohit AP, A Textbook of Pharmacognosy, 38th Edition, NiraliPrakashan, Pune, Maharashtra, India, 2017.
2. Sen A and Chakraborty R, Herbal Medicine in India: Indigenous Knowledge, Practice, Innovation and Its Value, 1st Edition, Springer, 2020.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20MPBO1CC4	Herbal Botany					4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓		✓				✓	
CO2	✓		✓	✓		✓	✓		✓	✓	
CO3	✓		✓	✓		✓	✓		✓	✓	
CO4	✓		✓	✓		✓			✓	✓	
CO5	✓		✓	✓		✓				✓	
Number of Matches = 30, Relationship: Moderate											

Prepared by:

1. Dr. M. Kamaraj

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Plant Biotechnology	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Recognize the commercial potential of plant biotechnology.
2. Summarize the nuances of plant tissue culture.
3. Develop crop improvement strategies.
4. Appraise the plants as living bioreactors.
5. Justify the applications of plant biotechnology for human values.

Unit I: 12Hours

Introduction to biotechnology: Definitions – scope of biotechnology – biotechnology in the world – biotechnology in India – #commercial potential of biotechnology#.

Unit II: 12Hours

Plant tissue culture – Definitions – maintenance of Aseptic conditions in laboratory – #totipotency of cells# – nutrient media – methods of tissue culture – embryo culture – anther culture – pollen culture – micropropagation – somatic embryogenesis.

Unit III: 12Hours

Applications of plant genetic engineering – crop improvement, herbicide resistance, insect resistance, virus resistance and plant as bioreactors.

Unit IV: 12Hours

Genetic modification in agriculture – transgenic plants, genetically modified foods application, future applications and #ecological impact of transgenic plants#.

Unit V: 12Hours

Medical and environmental biotechnology – biotechnology in medicine, vaccines, diagnostic, forensic, gene therapy. Sequence databases EMBL, #NCBI#, and DDBJ, protein structural databank and sequence.

#.....# Self-Study portion

Text Books:

1. Satyanarayana U. Biotechnology. 1st Edition. Books and Allied Pvt Ltd. Kolkata, India, 2005.
2. Slater A, Scott N and Fowler M, Plant Biotechnology: The genetic manipulation of plants, 2nd Edition, Oxford University Press Pvt Ltd, New Delhi, India, 2008.
3. Dubey RC, A Textbook of Biotechnology, 5th Edition, Chand & Company Pvt Ltd, New Delhi, India, 2014.

Books for Reference:

1. Glick BR and Pasternak JJ, Molecular Biotechnology, 3rd Revised Edition, American Society of Microbiology, Washington, America, 2002.
2. Smith JE, Biotechnology, 4th Edition, Cambridge University Press Pvt Ltd, United Kingdom, 2004.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
I	20MPBO1CC4	Plant Biotechnology					4	4		
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓					✓			✓	✓
CO2	✓					✓		✓	✓	✓
CO3	✓		✓		✓	✓		✓	✓	✓
CO4	✓		✓		✓	✓			✓	✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches = 30, Relationship: Moderate										

Prepared by:

1. Dr. R. Ravikumar

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Tropical Palynology	4	4	100	25	75

Semester	Code	Title of the Paper	Hours	Credits
----------	------	--------------------	-------	---------

Course Outcomes:

At the end of the course, students will be able to

1. Identify pollen and spores as a suitable tool to study in fresh and fossil forms.
2. Classify the types of pollen grains based on morphology and ornamentation.
3. Employ pollen analysis as a tool applied in various fields.
4. Appraise factors affecting modern pollen rain and its relevance to investigations.
5. Justify the pollen as a suitable plant remain for studying spacio-temporal marker in tropics.

UnitI 12Hours

Pollen preparations: laboratory procedures – acetolysis of fresh material – acetolysis of herbarium specimens and surface soil samples – #other alternative methods (Woodhouse preparation)#.

UnitII 12Hours

Pollen and spore morphology: terminologies and glossary – Pollen diagnostics – Descriptions and illustrations of major types (porate, aporate, colpate, colpporate types) – typical pollen morphology in selected pollen types (Poaceae type, Compositae-echinate type, *Syzigium* type, #*Croton* type#).

UnitIII 12Hours

Pollen analyses – Graphic presentation off results – tabulation and calculation of percentages – pollen spectra and pollen diagrams. Applications of pollen analysis – Correlations: palaeo-climatology, geology and #archaeology#.

UnitIV 12Hours

Modern pollen rain – surface samples - composition of pollen rain – flotation and water transport of pollen – surface receptivity - #pollen flora of surface samples#.

Unit – V 12Hours

Pollen flora of peat samples and sediments: Differential resistance of pollen: specific resistance to decay – Individual resistance to decay downwash of pollen through peat pollen frequency – #quantification of absolute pollen frequency of sediment samples#.

#.....# Self-Study portion

Text Books:

1. Moore PD and Webb JA, An Illustrated Guide to Pollen Analysis, 1st Edition, Hodder and Stoughton Pvt Ltd, London, UK, 1978.
2. Faegri K, Kaland PE and Krzywinski K, Textbook of Pollen Analysis, 4th Edition, The Blackburn Press Pvt Ltd, New Jersey, United State of America, 2000.
3. Bhattacharya K, Majumdar MR and Bhattacharya SG, A Textbook of Palynology, 3rd Revised Edition, New Central Book Agency Pvt Ltd, Kolkata, India, 2011.

Books for Reference:

1. Erdtman G, Pollen Morphology and Plant Taxonomy: Angiosperms (In Introduction to Palynology Series-Volume 1), Almquist and Wiksell Pvt Ltd, Stockholm, Sweden, 1952.
2. Kremp G, Morphologic Encyclopedia of Palynology: An international Collection of Definitions and Illustrations of Spores and Pollens, 1st Edition, University of Arizona Press Pvt Ltd, Arizona, United State of America, 2019.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

I	20MPBO1CC4	Tropical Palynology				4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓				✓	✓		✓	✓	✓
CO2	✓				✓	✓		✓	✓	✓
CO3	✓		✓		✓	✓			✓	✓
CO4	✓		✓		✓	✓			✓	✓
CO5	✓		✓		✓	✓			✓	✓
Number of Matches = 30, Relationship: Moderate										

Prepared by:

1. Dr. A. Aslam

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBO1CC4	Core – IV (Elective)	Plant Biotechnology	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Recognize the facets of plant biotechnology.
2. Summarise the types and applications of plant tissue culture media.
3. Enumerate various types and applications of different culture methods.
4. Apply various *in vitro* methods for secondary metabolite production.
5. Justify the plant biotechnology interventions to use them as living bioreactors.

Unit I

12Hours

Introduction – History of plant tissue culture – laboratory organization. Tools and techniques of plant tissue culture. Mass production of plantlets – hardening and mist chambers – transplantation to field – techniques for maintaining plantlets in the field. #Importance and application of tissue culture – impacts on industry, forestry, agriculture and horticulture#.

Unit II

12Hours

#Sterilization – methods of sterilization# – medium and its preparation – plant growth regulators (PGR), macro & micro nutrients, vitamins and its role in tissue culture. Inoculation – methodology, types of cultures – Solid – Liquid.

Unit III

12Hours

Culture initiation – explant – totipotency – dedifferentiation – redifferentiation – various types of culture – callus culture, cell culture, anther culture, #meristem culture#. Organogenesis – direct & indirect method and somatic embryogenesis.

Unit IV

12Hours

Micropropagation – methods of micropropagation – plant protoplast – isolation, culture and somatic hybridization – #Somaclonal variation#. Secondary plant products – secondary metabolites of plants, factors affecting the production in culture, elicitors and roots.

Unit – V

12Hours

Bio-transformation – immobilization of cells and its application – cryopreservation – germplasm conservation and establishment of gene banks – Synseed technology, Markers based on PCR amplification# – RAPD – AFLP, golden rice and #delayed fruit ripening#.

#.....# **Self-Study portion**

Text Books:

1. Satyanarayana U. Biotechnology. 1st Edition. Books and Allied Pvt Ltd. Kolkata, India, 2005.
2. Slater A, Scott N and Fowler M, Plant Biotechnology: The genetic manipulation of plants, 2nd Edition, Oxford University Press Pvt Ltd, New Delhi, India, 2008.
3. Dubey RC, A Textbook of Biotechnology, 5th Edition, Chand & Company Pvt Ltd, New Delhi, India, 2014.

Books for Reference:

1. Glick BR and Pasternak JJ, Molecular Biotechnology, 3rd Revised Edition, American Society of Microbiology, Washington, America, 2002.
2. Smith JE, Biotechnology, 4th Edition, Cambridge University Press Pvt Ltd, United Kingdom, 2004.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20MPBO1CC4	Plant Biotechnology					4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓				✓	✓		✓	✓	✓	
CO2	✓					✓		✓	✓	✓	
CO3	✓		✓			✓		✓	✓	✓	
CO4	✓		✓			✓		✓	✓	✓	
CO5	✓		✓		✓	✓		✓	✓	✓	
Number of Matches = 30, Relationship: Moderate											

Prepared by:

1. Dr. K. Mohamed Rafi

Checked by:

1. Dr. A. Aslam

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very High