

# **M.Sc.,BOTANY**

## **SYLLABUS (with effectfrom July2021)**



**DepartmentofBiology  
TheGandhigramRuralInstitute(DeemedtobeUniversity)Ga  
ndhigram - 624 302  
DindigulDistrict  
Tamil  
NaduIndia**

**OBEElementsforM.Sc.,BotanyProgramme**

**PROGRAMME EDUCATIONAL OBJECTIVES(PEO)**

PEO1: To gain technical aptitude and in-depth knowledge in the relevant field.

PEO2: To independently carry out practicals, project and interpret the results scientifically. PEO3:

To utilize the skills developed for gainful employment.

PEO4: To update their knowledge periodically to match international standards.

PEO5: To enhance the intellectual foundation and prepare themselves for life in a complex, dynamic and technological world.

PEO6: To preserve, add to and transmit knowledge in the relevant field.

**PROGRAM OUTCOME(PO)**

PO1: Become knowledgeable in the subject and apply the principles of the same to the needs of the Employer / Institution / Enterprise / Society

PO2: Gain Analytical skills in the relevant field.

PO3: Be able to design/conduct investigations and develop solutions to solve problems using appropriate tools.

PO4: Use knowledge gained from the public health and safety, cultural, societal and environmental needs which are friendly and sustainable.

PO5: Work individually/as group, have professional ethics, able to prepare & execute projects and use knowledge obtained / update it lifelong.

**PROGRAMME SPECIFIC OUTCOME(PSO)**

After completion of Botany Programme, the students are expected to

PSO1: Apply the knowledge of Botany in the domain of scientific development

PSO2: Solve the complex problems in the field of Botany with an understanding of the societal, legal and cultural impacts

PSO3: Use specialized knowledge and practical training on Botany to address contemporary problems in academia, industry and needs of society

PSO4: Are research-

oriented learning that develops analytical and integrative problem solving approaches.

PSO5: Relate scientific knowledge to research on the topic, perform experimentation, collect, analyze and present data.

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M.Sc.,BOTANYPROGRAMME

Name of the programme	MSc.BOTANY				
Year of Introduction	2008				
Year of revision	2 0 2 1				Total
Semesterwise courses and credit distribution	I	II	III	IV	
No. of Courses	7	8	8	7	30
No. of Credits	22	24	22	24	92

SCHEME OF EXAMINATION

S.No	Semester	Course Code	Course Title	Nature of the course	C	L	P	E	CFA	ESE	Total Marks
1.1	I	21BOTP0101	Plant Diversity	Major	4	4	-	3	40	60	100
1.2		21BOTP0102	Systematics of Angiosperms	Major	4	4	-	3	40	60	100
1.3		21BOTP0103	Environmental Biology	Major	4	4	-	3	40	60	100
1.4		21BOTP0104	Molecular Biology#	Major	4	4	-	3	40	60	100
1.5		21BOTP0105	Practical-1: Plant Diversity and Systematics of Angiosperms	Major	2	-	4	3	60	40	100
1.6		21BOTP0106	Practical-2: Environmental Biology	Major	2	-	4	3	60	40	100
1.7		21GTPP0001	Gandhi in Everyday Life	-	2	2	-	-	50	-	50
				<b>Total</b>		<b>22</b>	<b>18</b>	<b>8</b>			
2.1	II	21BOTP0207	Plant Physiology and Biochemistry	Major	4	4	-	3	40	60	100
2.2		21BOTP0208	Anatomy, Morphogenesis and Embryology of Angiosperms	Major	4	4	-	3	40	60	100
2.3		21BOTP0209	Cell Biology and Genetics	Major	4	4	-	3	40	60	100
2.4		21BOTP0210	Biostatistics	Major	4	4	-	3	40	60	100
2.5		21BOTP0211	Practical -3: Plant Physiology, Biochemistry, Anatomy and Embryology of Angiosperms	Major	2	-	4	3	60	40	100
2.6		--	Elective: Generic	Generic	3	3	-	3	40	60	100
2.7		21ENGP00C1	Communication and Soft Skills	Soft Skills	2	2	-	-	50	-	50
2.8		21BOTP0212	Summer Internship/Mini Project (15 to 30 days during II -Semester Break)	Major	1	--	-	-	50	-	50
			<b>Total</b>		<b>24</b>	<b>21</b>	<b>4</b>				

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S.No	Semester	CourseCode	CourseTitle	Nature of the course	C	L	P	E	CFA	ESE	Total Marks
3.1	III	21BOTP0313	Bioinstrumentation	Major	4	4	-	3	40	60	100
3.2		21BOTP0314	Plant Resource Utilization and Biodiversityconservation	Major	4	4	-	3	40	60	100
3.3		21BOTP0315	ForestEcology,Phytogeographyand Remotesensing	Major	4	4	-	3	40	60	100
3.4		21BOTP0316	Practical-4:Bioinstrumentation	Major	2	-	4	3	60	40	100
3.5		21BOTP03DX	Elective:DisciplineCentric	Discipline Centric	3	3	-	3	40	60	100
3.6		21BOTP03MX	Modularcourse	Modular	2	2	-	-	50	-	50
3.7		21BOTP0317	FieldVisit	Major	1	-	2	-	50	-	50
3.8		21EXNP03V1	VillagePlacementProgramme	VPP	2	-	-	-	50	-	50
				<b>Total</b>	<b>22</b>	<b>17</b>	<b>6</b>				
4.1	IV	21BOTP0418	FundamentalsofMicrobiology	Major	4	4	-		60	40	100
4.2		21BOTP0419	PlantBiotechnology and Genetic Engineering@	Major	4	4	-		60	40	100
4.3		21BOTP0420	Applied Mycology and Plant Pathology	Major	4	4	-		60	40	100
4.4		21BOTP0421	Practical -5: Fundamentals ofMicrobiology and Plant Biotechnology	Major	2	-	4		40	60	100
4.5		21BOTP04MY	Modular course-	Modular	2	2	-	-	50	-	50
4.6		21BOTP0422	Dissertation	Major	6	-	10		75	75* + 50* *	200
4.7		21GTPP00H1	Human Values and Professional Ethics	-	2	2	-		50	-	50
				<b>Total</b>	<b>24</b>	<b>16</b>	<b>14</b>				
			<b>GrandTotalcredit</b>		<b>92</b>						

<b>#coursesmaybeofferedunderMOOC/NPTEL basedonavailabilityandthesyllabuswillbemodifiedasperMOOC/NPTELwith equalcredits</b>	<b>@ A portion of the course may be offeredunderMOOC/NPTELbasedonavailability</b>
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*EvaluationbyExternal examiner	C-Credits
**EvaluationbyExternalexaminerandinternalexaminers	CFA-InsemestercontinuousAssessment
L-Lecturehours	ESE-Endsemester Assessment
P-Practicalhours	VPP-VillagePlacement Programme
E- Examhours	

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<b>List of Discipline Centric Courses (3credits)</b>	<b>List of Modular Courses(2Credits )</b>	<b>Generic Course offered to otherDepartments (3credits)</b>
21BOT P03D1 Trends in ModernBotany	21BOT P03M1 AdvancedMolecularTechniques	21BOTP02G1 Herbal Botany andDietetics
21BOT P03D2Phylogeny ofAngiosperms	21BOTP03M2Bioinformatics	21BOTP02G2 Preservation andProcessingofFruitsandVegetables
21BOT P03D3 ReproductiveBiologyofAngiosperms	21BOTP04M3 RuralBiotechnology	21BOTP02G3 Biofertilizer andMushroom technology
	21BOTP04M4CommercialPlanttissue Culture	
AnyotherMajorElectiveCourses under MOOC / NPTEL availableonline with equalcredits	21BOT P04M5 Intellectual PropertyRights	

### VALUEADDED COURSES

<b>Coursecode</b>	<b>CourseTitle</b>	<b>Credit</b>
21BOTP0VA1	RuralBiotechnology	2
21BOTP0VA2	CommercialPlanttissueCulture	2
21BOTP0VA3	PreservationandProcessingofFruitsandVegetables	2
21BOTP0VA4	BiofertilizerandMushroomtechnology	2

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Semester	First	CourseCode	21BOTP0101
CourseTitle	PLANTDIVERSITY		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageof revision effected (Minimum20%)	25
Category	Core		
Scope of theCourse (maybemore thanone)	1. Understandvariousformsflowerplants 2. AcquiretheknowledgeondiversityandreproductionofAlgae,Bryophytes,Pterid ophytes and Gymnosperms 3. Understandthephylogenyandeconomicimportanceofflowerplants		
CognitiveLe velsaddres sedbythe Course	K1-Inculcatethe advancementofdistributionandphylogenyofflowerplantsK2- Observation on diversity andreproduction offlower plants K3-AcquireknowledgeoneconomicimportanceofflowerplantsK4- Survey andevaluation offlower plant forms K5-Create awarenessamongthepeopleon fossilizationandfossilplants		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Toevaluatedistributionand phylogenyofflowerplants</li> <li>• Toanalysethediversity,reproductionandeconomicimportanceofAlgae</li> <li>• To evaluate the diversity, reproduction and economic importance of Fungi andGymnosperms.</li> <li>• TodemonstratediversityandreproductionofBryophytesandPteridophytes</li> <li>• ToanalysethedemonstratediversityandreproductionofGymnosperms</li> </ul>		
Unit	Content		No.of Hours
	<b>Algae</b> ClassificationofAlgaebyF.E.Fritsch(1935);Generalcharacteristics of all classes of Algae; Distribution, habitat, thallusorganization,reproduction(vegetative,asexual,sexual)andlifecy cleof <i>Chlorella</i> and <i>Polysiphonia</i> ;PhylogenyandEconomic importanceofAlgae.		13
	<b>Fungi&amp;Lichens</b> ClassificationofFungi byC.J.Alexopoulos(1962);Generalcharacteristi csofallclassesoffungi;Distribution,habitat,reproduction (vegetative, asexual, sexual) and lifecycle of <i>Rhizopus</i> and <i>Agaricus</i> ;EconomicimportanceofFungi.Generalcharacte risticsofLichens.Briefaccountonthe structureand reproductioninAscolichens,Basiodioliche nsandDeuterolichens.		12
	<b>Bryophytes</b> Classification of Bryophytes by Reimers (1954); General		15

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	characteristics of all classes of Bryophytes; Distribution, habitat, vegetative and anatomical structures, reproduction (vegetative, asexual, sexual) and life cycle of <i>Marchantia</i> and <i>Funaria</i> ; Phylogeny and Economic importance of Bryophytes.	
	<b>Pteridophytes</b> Classification of Pteridophytes by G.M. Smith (1955); General characteristics of all classes of Pteridophytes; Distribution, Morphology, anatomy, reproduction and life cycle of <i>Selaginella</i> and <i>Adiantum</i> ; Phylogeny and Economic importance of Pteridophytes.	14
	<b>Gymnosperms &amp; Paleobotany</b> Classification of Gymnosperms by K.R. Sporne (1965); General characteristics of all classes of Gymnosperms; Distribution, vegetative, anatomy, reproduction and life cycle of <i>Gnetum</i> ; Phylogeny and Economic importance of Gymnosperms. Brief account of process of fossilization, type studies on <i>Agalophyton</i> ( <i>Rhynia</i> ) and <i>Leptopteris</i> .	10
References	Text Books: 1. Vashista, P.C., Sinha, A.K. and Kumar, A. 2006. Gymnosperms. Revised Edition. S. Chand & Company Ltd, New Delhi. 2. Johri, R.M., Latha, S. and Sharma, S. 2004. Textbook of Algae. Dominant Publishers and distributors, New Delhi. 3. Johri, R.M., Latha, S. and Sharma, S. 2004. Textbook of Bryophytes. Dominant Publishers and distributors, New Delhi. 4. Vashista, P.C., Sinha, A.K. and Kumar, A. 2005. Pteridophyta. Revised Edition. S. Chand & Company Ltd, New Delhi. 5. Pandey, B.P. 2004. College Botany Volume I & II. S. Chand & Company Ltd, New Delhi. 6. Hoek, C., Mann, D., Jahns, H.M. and Jahns, M. 1995. Algae: an introduction to phycology. Cambridge university press. 7. Chapman, D.J., 1973. <i>The algae</i> . Springer. Reference Books 1. Gilbert. M. Smith 1998. Cryptogamic Botany. Volume 1 & 2. Tata McGrawhill Publishing Company Ltd, New Delhi. 2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. IV edition, John Wiley & Sons, New York. 3. Sporne. K.R. 1976. Morphology of Pteridophytes, 4 <sup>th</sup> edition, B.I. Publication. 4. Parihar. N.S. 1967. An introduction of Embryophyta, vol. III – Pteridophyta, Central book depot, Allahabad.	

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	<p>5. Chapman, V.J. 1962. <i>The Algae</i>. Macmillan &amp; Co. Ltd. New York.</p> <p>6. Sambamurty, A.V.S.S., 2005. <i>A textbook of algae</i>. IK International Pvt. Limited.</p> <p>7. Sharma, O.P., 1986. <i>Textbook of algae</i>. Tata McGraw-Hill Education.</p> <p>8. Gupta, R., 1981. <i>A textbook of fungi</i>. APH Publishing.</p> <p>9. Webster, J. and Weber, R., 2007. <i>Introduction of fungi</i>. Cambridge university press.</p> <p>10. Watkinson, S.C., Boddy, L. and Money, N., 2015. <i>The fungi</i>. Academic Press.</p> <p>11. Dube, H.C., 2013. <i>An introduction of fungi</i>. Scientific Publishers.</p> <p>12. Reddy, S.M., 2001. <i>University botany I: (algae, fungi, bryophyta and pteridophyta)</i> (Vol. 1). New Age International.</p> <p>13. Uetanabaro, A.P.T., Goes-Neto, A., Rosa, L.H., Salino, A., Wieloch, A.H. and Rosa, C.A., 2009. <i>Diversity of Prokaryotes, Fungi, Protozoa, Bryophytes, and Pteridophytes in Tropical ecosystems</i>. <i>Tropical Biology and Conservation Management</i> - Volume V: Ecology, p.13.</p> <p>14. Sambamurty, A.V.S.S., 2006. <i>A textbook of bryophytes, pteridophytes, gymnosperms and paleobotany</i> (No. QK533S25).</p> <p>15. Biswas, C. and B.M. Johri. 2004. <i>The Gymnosperms</i>, Narosa Publishing House, New Delhi.</p> <p>16. Kakkar, R.K. and B.R. Kakkar. 1995. <i>The Gymnosperms (Fossils and Living)</i> Central Publishing House, Allahabad.</p> <p>17. Parihar, N. S. 1991. <i>Bryophytes</i>, Central Book Dept., Allahabad.</p> <p>19. Rashid, A. (1976) <i>An introduction to Pteridophyta</i>, Vikas Publishing House Ltd., New Delhi.</p> <p>20. Sharma O. P. (2002) <i>Gymnosperms</i>, Pragati Prakashan, Meerut.</p> <p>21. Sharma P. N. and Sahni K. C. (2005) <i>Gymnosperms of India and Adjacent Countries</i> Publisher Bhishan Singh Mahendra Pal Singh, Dehradun.</p> <p>22. Sporne, K.R. (1976) <i>Morphology of Pteridophyta</i>. Hutchinson University Library, London.</p> <p>23. Shaw, A.J. and Goffinet, B. eds., 2000. <i>Bryophyte Biology</i>. Cambridge University Press.</p> <p>24. Siddiqui K.A. 2003., <i>Elements of paleobotany</i>. KITAB MHHAL Agencies, Allahabad. UP</p>	
	<p>On completion of the course, students should be able to understand CO1: Diversified forms of plants</p>	

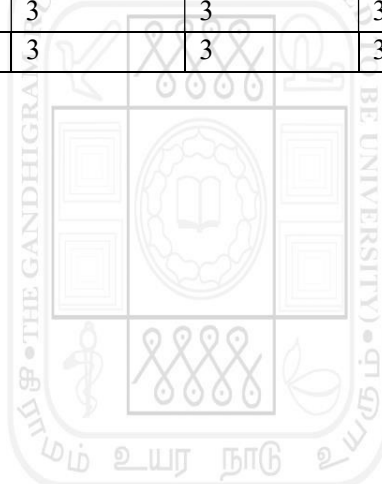


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	<p>CO2: Salient features of every classification and can describe the function of classification</p> <p>CO3: Compare critically the biology and ecology of fossil groups of plants</p> <p>CO4: Economic importance and special characteristics of the specified examples under each category</p> <p>CO5: Identification of fossil forms of Pteridophytes and Gymnosperms.</p>	
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### Mapping of Cos with PSOs

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	2	3	3	3	2



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Semester	<b>First</b>	CourseCode	<b>21BOTP0102</b>
Course Title	<b>SYSTEMATICSOFANGIOSPERMS</b>		
No.of Credits	4	No.ofcontacthoursper week	4
NewCourse/Revised Course	RevisedCourse	If revised, Percentage ofrevision effected (Minimum20%)	20
Category	Core		
Scope ofthe Course(may bemorethan one)	1. Understandthebasicand advancedaspectsof angiospermSystematics 2. Acquirethe knowledgeonvarious aspectsofangiosperm taxonomy 3. Motivatethestudentstounderstandthevariousaspectsofplanttaxonomyandtobecome Plant taxonomists		
Cognitive Levelsaddressedby the Course	K1-InculcatebasicandadvancementofangiospermtaxonomyK2-Realizethevariousissues on angiosperm taxonomy K3-Mullover thetechniquesto solvetheproblems inbotanicalnomenclatureK4-Expertise on the identification ofvariousangiosperm families. K5-Realizetheimportanceofangiospermtaxonomy onvarious botanicalissues		
CourseObjectives(Maximum: 5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Tocomparethevariousssystemof classificationproposed inplants</li> <li>• Toanalysethevariousaspectsofplantnomenclatureandclassification</li> <li>• Tounderstandtheclassical andmoderntrends of Angiospermtaxonomy</li> <li>• Toanalyse themethodology and applicationsof phylogenyofAngiosperms</li> <li>• Tostudythesalientfeaturesofangiospermfamilieswithspecialreferencetosexualcharacters.</li> </ul>		
Unit	Content	No.of Hours	
I	<b>Introductiontoplanttaxyonomy</b> History of plant classification; Detailed study on sexual system: CarolusLinnaeus; Natural system: Bentham & Hooker; Phylogenetic systems:Bessey,HutchinsonandTakhtajan;AngiospermPhylogeneticGroup :BriefoutlineofAPG-I(1998),APG-II(2003),APG-III-(2009), AGP-IV(2016). Construction of taxonomic keys: Indented and bracketedkeys.	13	

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II	<p><b>Botanical nomenclature</b>                      ICBN: International code of Botanical Nomenclature; principles of ICBN; Typing method; Author citation; Retention and rejection of names; Publication of names; Effective and valid publication; Brief account on rules and regulations of ICN. Taxonomic evidences obtained from Anatomy, Embryology and Palynology, Chemotaxonomy; Brief account on software based plant identification systems; e-floras; Virtual herbaria; Interactive keys.</p>	12
III	<p>Phylogeny of Angiosperms: Origin and evolution of angiosperms; Phylogenetic systematics: The principles, methodology and applications of phylogenetic analyses includes taxon selection, character analysis, cladogram construction and cladogram analysis. Molecular data for phylogenetic analysis and identification:</p>	15
IV	<p><b>Morphology and Characters of important families</b>                      Salient features; Vegetative and sexual characters of Magnoliaceae, Cappariaceae, Menispermaceae, Rhamnaceae, Meliaceae, Lythraceae, Fabaceae, Sapindaceae, Combretaceae, Vitaceae, Myrtaceae, Euphorbiaceae, Passifloraceae and Polygalaceae.</p>	14
V	<p><b>Morphology and Characters of important families</b>                      Salient features; Vegetative and sexual characters of Rutaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Lauraceae, Aristolochiaceae, Loranaceae, Rubiaceae, Commelinaceae, Orchidaceae, Cyperaceae and Poaceae.</p>	10
References	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>Sharma, O.P. 2013. Plant Taxonomy. McGraw Hill Education Pvt. Ltd. New Delhi.</li> <li>Sharma, O.P., 1993. Plant taxonomy. Tata McGraw-Hill Education.</li> <li>Mondal, A.K. 2005. Advanced Plant Taxonomy. New Central Book Agency (P) Ltd., New Delhi.</li> <li>Johri, R.M. 2005. Taxonomy. Vols. I-IV, Sonali Publication, New Delhi.</li> <li>Bhattacharyya, B. 2005. Systematic Botany. Narosa Publishing House, New Delhi.</li> <li>Subramanyam, N.S. 1999. Modern Plant Taxonomy. Vikas Publishing House, New Delhi.</li> <li>Stace, C.A., 1991. Plant taxonomy and biosystematics. Cambridge University Press.</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>Simpson, M.G. 2018. Plant Systematics. Academic Press, London</li> <li>Pandurangan, A.G. Vrinda, K.B. and Mathew Dan. 2013. Frontiers in plant taxonomy. JNTBGRI, Thiruvananthapuram, Kerala.</li> <li>Pullaiah, T. 2007. Taxonomy of Angiosperms. 3<sup>rd</sup> Edition, Regency Publication, New Delhi.</li> <li>Sivarajan, V.V. 1996. Principles of plant taxonomy. Oxford and</li> </ol>	

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	<p>IBHpublishingCo.Pvt.Ltd,NewDelhi.</p> <ol style="list-style-type: none"> <li>5. Lawrence:Taxonomyof VascularPlants</li> <li>6. Sivarajan, V.V.(Ed.Robson).IntroductiontoPrinciplesofPlantTaxonomyLawrence,G.H.M.,1955.Anintroductiontoplanttaxonomy.AnIntroduction to Plant Taxonomy.</li> <li>7. Jeffrey,C.,1982. <i>An introductiontoplant taxonomy</i>.CUPArchive.</li> <li>8. Sivarajan,V.V.,1991. <i>Introductiontotheprinciplesofplanttaxonomy</i>.CambridgeUniversity Press.</li> <li>9. Rouhan, G. and Gaudeul, M., 2014. Plant taxonomy: A historicalperspective, current challenges, and perspectives. In <i>Molecular PlantTaxonomy</i> (pp. 1-37). HumanaPress,Totowa, NJ.</li> <li>10. Simpson,M.G.,2019. <i>Plantsystematics</i>.Academicpress.</li> <li>11. Douglas C. Daly, Kenneth M. Cameron, Dennis W. Stevenson, <i>PlantSystematics in the Age of Genomics, Plant Physiology</i>, Volume 127,Issue4, December2001,Pages 1328–1333.</li> <li>12. DonovanBailey,C.,2008.<i>PlantSystematics:APhylogeneticApproach</i>.</li> <li>13. RavenPH,MertensTR.<i>Plantsystematics:theoryandpractice</i>.BSCSPam . 1964-1965; 23:1-36. PMID: 5870805.</li> <li>14. Cronquist, R. <i>The Evolution and classification of flowering plants</i>(1988)</li> <li>15. Cronquist 1981. An intergerated system of classification of floweringplants</li> <li>16. Takhtajan, K. Outline of classification of flowering plants. <i>BotanicalRev</i>.46:225-359),1980</li> <li>17. Jones,S.B.&amp;Luchsinger,A.E.<i>Plantsystematics</i>,1988</li> <li>18. Davis,P.H. &amp; V.H.Heywood. <i>Principles ofAngiospermTaxonomy</i></li> <li>19. Henry &amp; Chandrabose. An aid to Interntional Code of BotanicalNomenclature</li> <li>20. Dunn,C.andB.S.Veritt. AnintroductiontoNumericalTaxonomy</li> <li>21. International code of Botanical Nomenclature – 2000. (Int.Associationof Plant Taxonomist Pub.) Utrecht.</li> <li>22. Takhtajan1997.<i>DiversityandClassificationoffloweringplants</i>.ColumbiaUniv. Press, New York.</li> <li>23. Nordenstamb.,El/GazalayandKasasM.2000.<i>PlantSystematicsfor21st Century</i>. Portland Press Ltd., London.</li> <li>24. WoodlandDW1991,<i>ContemporaryPlantsystematics</i>,PrenticeHall,New Jersey.</li> </ol> <p>Websites  <a href="https://biologyboom.com/introduction-to-plant-systematics">https://biologyboom.com/introduction-to-plant-systematics</a><a href="https://courses.botany.wisc.edu/botany_400/Lecture/0pdf/01Introduction">https://courses.botany.wisc.edu/botany_400/Lecture/0pdf/01Introduction</a></p>	
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	<p>n.pdf<a href="https://biocyclopedia.com/index/plant_systematics.php">https://biocyclopedia.com/index/plant_systematics.php</a></p> <p><a href="https://byjus.com/neet/important-notes-of-biology-for-neet-plant-taxonomy/">https://byjus.com/neet/important-notes-of-biology-for-neet-plant-taxonomy/</a><a href="https://www.biologydiscussion.com/essay/angiosperms-essay/taxonomy-of-angiosperms-aims-and-principles-essay-botany/76587">https://www.biologydiscussion.com/essay/angiosperms-essay/taxonomy-of-angiosperms-aims-and-principles-essay-botany/76587</a></p>	
	<p>Oncompletionofthecourse, studentsshouldbe ableto</p> <p>CO1:Describe the types; merits &amp; demerits of various systems ofclassification</p> <p>CO2:Comparetheclassicalplanttaxonomywithmodernmolecularphylogeny</p> <p>CO3:AssesstheconceptsofandapplicationsofphylogenyofAngiosperms</p> <p>CO4:CritiquethenormsofICBNandConstructionofkeys</p> <p>CO5:Identifytheangiospermsfamilieswithspecifickeycharacters.</p>	

### **Mapping of Cos with PSOs**

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	2	3
CO2	3	3	2	3	3
CO3	3	2	3	2	2
CO4	3	3	3	3	3
CO5	2	3	3	2	2

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Semester	<b>First</b>	CourseCode	<b>21BOTP0103</b>
CourseTitle	<b>ENVIRONMENTALBIOLOGY</b>		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ RevisedCourse	RevisedCourse	Ifrevised,Percentageof revision effected	20
Category	Core		
ScopeoftheCourse( may be more thanone)	1. Understandthe conceptsofenvironment 2. Useofnaturalresourcesmoreeffectivelywithoutharming theenvironment. 3. Importance of remote sensing, GIS, Environmentaleducation, pollutionand its effects, environmental quality monitoring, impact assessment andconservation.		
Cognitive Levelsaddressed by theCourse	K1-Inculcatetheadvancedenvironmentalconcepts K2-ObservationofenvironmentalissuestothepresentscenarioK3- Applicationofrecenttechniques inpollutionreduction. K4-Surveyandevaluationofnaturalresourcesanditsmanagement. K5-Awareness amongthepeopleonenvironmentalissues		
Course Objectives(Maxi mum:5)	TheCourseaims <ul style="list-style-type: none"> <li>• toprovidefundamentalenvironmentalprincipleshatprovidesanin- depthunderstandingof ourenvironment.</li> <li>• tounderstandhowenvironmentalsystemsinterferewithpopulationandwealthe f our natural resources</li> <li>• tounderstandtheimportanceofremotesensing,GISandenvironmentaleducatio n</li> <li>• tolearntheimpact ofpollutionon environmentandEnvironmentalActs</li> <li>• toassesstheimportanceenvironmentalimpactassessmentandaudit,biomonit oringand treatment</li> </ul>		
Unit	Content		No.ofHo urs
I	<b>EnvironmentalConcepts</b> Scope of Environmental Biology- Ecosystem- Abiotic andBioticcomponents- Types-Terrestrial-ForestandGrassland - Aquatic- Freshwater and Marine- Food chain and food web,ecologicalpyramids- Productivity-Primaryandsecondary-Biogeochemicalcycles- Oxygen,carbon,nitrogen,sulphur andphosphorus-PopulationEcology.		13
II	<b>NaturalResourcesandConservation</b> NaturalResources-Renewable-Biomass,biogas,solarenergy, wind, tidal energyand Non-Renewable- Fossil fuels-coal,oil,naturalgas,mineralandnuclearenergy- Conservationofnaturalresources-Biodiversity-Status, types, threats and biodiversity hotspots- Wildlife		14

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	Conservation and management-National parks, sanctuaries and biosphere reserves.	
III	<b>Remote Sensing, GIS and Environmental Education</b> Remotesensing-Components, types and applications-GIS and its application-Environmental Education-Objectives, goals, scope, guiding principles and Centre for Environmental Education.	8
IV	<b>Pollution and Environmental Acts</b> Pollution-Types-Air,water,soilandradio-active sources, biological effects and control-Environmentalprotectionsacts-Air and water-Environmental Laws.	11
V	<b>Environmental Impact Assessment, Monitoring and Treatment</b> EnvironmentalImpactAssessment-stepsandmethods-Publicparticipationinenvironmentaldecisionmaking-Impact Analysis and Environmental Audit- Green Audit -Environmental Standards-Air and water-Bio indicators and Environmental Monitoring-Bioassay-Application in Environment - Physical, chemical and biological treatment of liquid effluents.	18
Referenc es	<p><b>TextBooks</b></p> <ol style="list-style-type: none"> <li>1. P.S.Verma and V.K.Agarwal. 2019. Environmental Biology. S.Chand andCompany,NewDehi.</li> <li>2. P.D. Sharma2017.Ecology and Environment- Rastogi Publication,Meerut.</li> <li>3. Purohit, Shammi&amp; Agrawal 2012 Environmental Sciences – A NewApproach Agrobios(India), Jodhpur.</li> <li>4. Metcalf and Eddy 2011 Waste water Engineering- Treatment andReuse.TataMcGrawHillEducationPvt.Ltd,NewDelhi.Pp.311-1026.</li> <li>5. S.K.Agarwal. 2002 Eco – informatics. Vol I, III, IV APH pub. Company,New Delhi. Vol. I: 135 – 165 : 265 – 311; Vol.III : 221 – 259; Vol. IV :1-140.</li> <li>6. KailashThakur1997Environmentalprotectionlawandpolicyin India. DeepandDeeppub.New Delhi.pp.184-197; 210– 248.</li> </ol> <p><b>ReferenceBooks</b></p> <ol style="list-style-type: none"> <li>1. G.TylerMillerandScottE.Spoolman.2019.EnvironmentalScience.Cengage Learning IndiaPvt.Ltd.Delhi.</li> <li>2. P.D. Sharama 2013, Environmental Biology and Toxicology- RastogiPublication,Meerut.</li> <li>3. PushpaDahiyaandManishaAhlawat2013Environmental Science- A NewApproach,NarosaPub.House, New Delhi.pp.2.1-2.60.</li> </ol>	

## M.Sc.BotanySyllabus(July2021onwards)

	<p>4. V.S.Kulkariani,S.N.KawandR.K.Trivedy2002.Environmental ImpactAssessmentforwetlandprotection.Scientificpublishers(India).</p> <p>5. Kaiser Jamil 2001 Bio indicators and biomarkers of EnvironmentalpollutionandRiskassessment.OxfordandIBHPub.Co.Pvt. Ltd,NewDelhi.pp.1 – 168.</p> <p>6. RajeshGopinathandN.Balasubramanya.2018. EnvironmentalScience andEngineering.CengageLearning India Pvt.Ltd.pp.36-179.</p> <p><b>E-Resources</b></p> <p>1. <a href="http://nptel.ac.in/courses/122103039/40">http://nptel.ac.in/courses/122103039/40</a></p> <p>2. <a href="http://b-ok.xyz/book/671429/bc900f3">http://b-ok.xyz/book/671429/bc900f3</a>.<a href="http://b-ok.xyz/book/2463090/f0ce34">http://b-ok.xyz/book/2463090/f0ce34</a></p>
CourseOutcomes	<p>Oncompletionofthecourse, studentsshouldbe ableto</p> <p>CO1 : Understand the components of environment, ecosystems,interactionsoforganisms,andappreciatehowelementsare recycling intheenvironment</p> <p>CO2:Identifythenaturalresources,typesofbiodiversityandstatusandimportanceofnational parks,sanctuaries andbiospherereserves</p> <p>CO3:Understandremote sensing,GISandtheirapplications</p> <p>CO4:Describethetypes,biological effects andcontrolofpollutionandtheimportanceofEnvironmental Acts.</p> <p>CO5:RecognizetheneedofEnvironmental impactassessment, environmentalaudit,monitoringandtreatmentofeffluents.</p>

### MappingofCoswithPSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	3
CO2	3	3	3	3	2
CO3	2	2	2	2	2
CO4	2	3	2	2	3
CO5	2	3	3	3	2



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Semester	<b>FIRST</b>	CourseCode	<b>21BOTP0104</b>
CourseTitle	<b>MOLECULARBIOLOGY</b>		
No.ofcredits	4	No.ofcontacthoursper week	4
New Course /RevisedCourse	Revised Course	Ifrevised,percentageof Revisioneffected <b>(Minimum 20%)</b>	30%
Category	Corecourse		
Scope of theCourse(May bemorethanone )	<ul style="list-style-type: none"> <li>❖ Basicunderstanding onthemoleculesoflife</li> <li>❖ Developingskillstoforanalysismutagenesis</li> <li>❖ Createsemployabilityscopeinthemolecularscreeninglaboratories</li> </ul>		
Cognitive Levelsaddressed by thecourse	K-1 Abilitytorememberhistoricaldevelopmentsofmolecularbiology K-2 Comprehensiveknowledgeon molecules oflife K-3 UsemoleculartechniquesforbetterunderstandingofstructuresofDNA, RNAand Proteins K-4 Capacitytoanalyse mutagenesisandmolecularrecombination K-5 Make newtechniques tostudymolecularmechanismofantisensemolecules K-6 Assessmentoffunctions ofDNA, RNAandProteins		
CourseObjectives	Thecourse aimsto: <ul style="list-style-type: none"> <li>• impartinformationonthehistoricaldevelopmentsofmolecularbiologyandmolecules oflife</li> <li>• giveanin-depthknowledgeonmutagenesis</li> <li>• makethestudentknowledgeableonconceptsandmechanismofDNA replicationprocess</li> <li>• exposethestudentsonmechanismsoftranscriptionprocessinprokaryotesand in eukaryotes.</li> <li>• enhancestudent's interesttodistinguishtranslationprocessesinprokaryotes with eukaryotes.</li> </ul>		
<b>UNIT</b>	<b>Content</b>		<b>No. ofHours</b>
<b>I</b>	<b>IntroductiontoMolecularBiology</b> Introductionandhistoricaldevelopment- CentraldogmaofMolecularbiology.TheLogicofmolecularbiology– theefficientargument,examinationof modelsandstronginference.Molecules oflife –DNA world – RNA world and protein world.Prokaryotic and Eukaryotic Chromosomeorganization.Genes – definition, types and functional organization. Finestructure of gene - Benzers classical studies on rII locus. Structure of DNA - primary,secondaryanddifferentforms(A,B&Z).Genetransfermechanism- bacterialtransformation, conjugationand transduction.		13

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<p><b>II</b></p>	<p><b>MutagenesisandRecombinationatthemolecularlevel</b> Mutation–Types–Molecularandbiochemicalbasisofmutation.Mutagenesis – Spontaneous and induced – Base – analog, physical agents,chemical mutagens, intercalating substances and mutator genes.Reversion –definition – Types – Mechanisms – application (Ames test). Mutants – TypesandUses– bacterialmutants,plantmutantsandanimalmutants.Recombinationatthemolecul arlevel.Crossingoverduringcelldivisionbreakage and rejoining of intact DNA molecules, Holliday model ofhomologous recombination – events at the molecular level; role of recA,recBC and chi sequences, Site- specific recombination – eg.bacteriophageλ;FLP/FRTand Cre/Loxrecombination.</p>	<p>13</p>
<p><b>III</b></p>	<p><b>DNAReplication</b> Basicrule.TheGeometryofDNAreplication–Semi- conservativereplicationofdouble– strandedDNAandCircularDNAmolecules.Enzymology – DNA Polymerases, DNA ligase and DNA gyrase.Events inthereplicationfork– Continuousanddiscontinuous.PlasmidandØ174 DNAreplication-DNA damages–DNArepairmechanism– photoreactivation,excisionrepair,recombinantrepairandDSOS function..</p>	<p>13</p>
<p><b>IV</b></p>	<p><b>Transcription</b> Basic factors of RNA Synthesis -RNA ploymerases – I, II and III - TranscriptionMechanisms in prokaryotes – and eukaryotes – chain Initiation,elongation and termination. Significance of pribnow box, TATA box, CAATboxandenhancersintranscriptioninitiation.RhodependentandRhoindepe ndentterminationoftranscription.ClassesofRNAMolecules–Messenger, ribosomal and transfer RNA. Post –transcriptional modification -RNA splicing – role of lysozyme – Spliceosomes, Group I and Group IIintrons Self-splicing.Capping and tailing of 5’ and 3’ termini of EukaryoticmRNAmolecules.AntisenseandRibozyometechnology– Molecularmechanism of antisense molecules -inhibition of splicing, polyadenylation,and transition – disruption of RNA structure and capping - biochemistry ofribozyme(hammerhead,hairpin,andotherribozyme)– strategiesfor designingribozymes–applicationsofantisenseandribozymetechnologies.</p>	<p>13</p>
<p><b>V</b></p>	<p><b>Translation</b> Geneticcode–Definition,decipheringofcodons–Universalityofthecode – Wobble hypothesis and codon degeneracy - codon dictionary.Mechanismofproteinsynthesis- importanceofInitiation(IF),elongation(EF)andreleasing factors(RF) - post translational modifications – protein splicingand folding – role of molecular chaperones. Regulation of gene expressionin prokaryotes –Operon concept – inducible and repressible operons Eg. lac,trp, ara, and his operons; global nutrient (carbon, nitrogen) status sensingmechanisms – link to gene expression. Bacterial small RNA (sRNA) and itsroleinregulationofgeneexpression.Functionalgenomics,Validationofgenefu nction.Genesilencing,PTGS,RNai,Antisensetechnology,Applications.Molecu larPharming.GenomeEditingtools-ZFNs,TALENs andCRISPR-Cas9.</p>	<p>12</p>

## M.Sc.BotanySyllabus(July2021onwards)

References	<p><b>TextBooks</b></p> <ol style="list-style-type: none"> <li>DavidFreifelder,2020,MolecularBiology,4<sup>th</sup>Reprint.,NarosaPublishingHouse,NewDelhi,India.</li> <li>JocelynE.Krebs,ElliottS.Goldstein,StephenT.Kilpatrick,2017.Lewin’sGenesXII Oxford University Press.</li> <li>Lansing M. Prescott, John P. Harley and Donald A. Klein(2008).Microbiology(7thEd.). McGrawHill companies.</li> <li>H.D.Kumar,1993,MolecularBiology&amp;Biotechnology,VikaspublishinghousePvt. Ltd., New Delhi.</li> </ol> <p><b>ReferenceBook</b></p> <ol style="list-style-type: none"> <li>R.F.WeaverandP.W.Hedrick1992,GeneticsWh.C.Brownpublishers,Dubuque.</li> <li>E.J.Gardner,M.J.Simmons,D.P.Snustad,2006.PrinciplesofGenetics(8<sup>th</sup>Ed.),John Wiley &amp; Sons, New York.</li> <li>Buchanan,GruissumandJones,(2000).BiochemistryandMolecularBiologyof Plant; ASPP, USA.</li> <li>DavidRawn(2012).Biochemistry.PanimaPublishers.</li> <li>RichardCalendar(2005).TheBacteriophages,2ndEdition,OxfordUniversityPress.</li> <li>Albertsetal.,Molecular BiologyoftheCell,GarlandPublications,(2012).</li> </ol> <p>*(NPTEL)-NationalProgrammeonTechnologyEnhancedLearning.</p> <p><b>Webresources</b></p> <ol style="list-style-type: none"> <li><a href="http://www.cellbio.com/education.html">www.cellbio.com/education.html</a></li> <li><a href="https://www.loc.gov/rr/scitech/selected-interval/molecular.html">https://www.loc.gov/rr/scitech/selected-interval/molecular.html</a></li> <li><a href="http://global.oup.com/uk/orc/biosciences/molbio/">global.oup.com/uk/orc/biosciences/molbio/</a></li> <li><a href="https://www.loc.gov/rr/scitech/selected-internet/molecular.html">https://www.loc.gov/rr/scitech/selected-internet/molecular.html</a></li> </ol>
Course Outcomes	<p>Uponcompletionofthiscourse,studentsbeableto:</p> <p>CO1:Outlinethe fundamentalconcepts ofmolecules oflife</p> <p>CO2:Discuss the various kinds of mutagenesis and their importance</p> <p>CO3:ExplainthemechanismsofDNA replication&amp;repairmechanisms</p> <p>CO4:Evaluatethedifferencesoftranscriptionprocessinprokaryoteswitheukaryotes</p> <p>CO5: Comparethemechanismsof translationinprokaryoteswiththatin eukaryotes</p>

CO \ PSO	PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		2	2	1	2	2
CO2		2	2	1	2	2
CO3		2	2	1	2	2
CO4		2	2	1	2	2
CO5		2	2	1	2	2

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Semester	First	CourseCode	21BOTP0105
CourseTitle	<b>PRACTICAL-I:PLANTDIVERSITY ANDSYSTEMATICS OF ANGIOSPERMS</b>		
No.ofCredits	2	No.ofcontacthoursper week	4
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageofrevisioneffected(M inimum 20%)	20
Category	Core		
Scope of theCourse (maybemore thanone)	1. Understandthe characteristicsofflower andhigherplants 2. Acquirethe knowledgedidentification offlowerand higherplants 3. Motivatethestudentstounderstandtheimportanceofplanttaxonomyandtobecom e Plant taxonomists		
CognitiveLe velsaddresse dbythe Course	K1-Inculcatebasic andadvancementofplanttaxonomy K2-Realizethevarious issueson identification of plantdiversity K3- Mull over the techniques to solve the problems in plant identificationK4-Expertise on theidentificationofflower plants andhigherplants. K5-Realizetheimportanceofidentificationofplantdiversity on various botanicalissues		
CourseObjecti ves(Maximum :5)	TheCourseaims • Todeveloptheskillon theidentificationofflower and higherplants withtheirsalient features • Todeveloptheskills onpreparationofherbariumforidentification • Tocreateanoverall knowledgeontheidentification ofallgroupof plantsincluding fossil • Tounderstandthedichotomouskeypreparationofangiospermfamilies.		
Unit	Content	No.of Hours	
I	Morphology of vegetative andreproductive characteristics of thefollowing: <b>Algae:</b> <i>Hydrodictyon, Bulbochaete, Pithophora, Stigeoclonium, Fritsch iella, Codium, Halimeda, Dictyota, Padina, Fucusand Batrochospermu m, Sargassum, Gracilaria,</i> <b>Fungi:</b> <i>Rhizopus, Peziza, Aspergillus, Agaricus, Polyporusand Lycoperdon</i> <b>Bryophytes:</b> <i>Riccia, Marchantia, Plagiochasma, Dumortieraand Polytrichum, Funaria</i> <b>Pteridophytes:</b> <i>Psilotum, Lycopodium, Selaginella, Adiantum, Pteridium, Polypodium and Azolla</i> <b>Gymnosperms:</b> <i>Cycas, Pinusand Gnetum</i> <b>Fossilforms:</b> <i>Agalophyton(Rhynia), Calamites, Bothrodendron,</i>	13	

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	<i>Calamostachys, Lyginopteris, Heterangium, Cordaite, and Cardiocarpus</i> <b>Lichens:</b> Usnea	
II	Salient features, vegetative and sexual characters of the following families: Salient features; Vegetative and sexual characters of Magnoliaceae, Capparidaceae, Menispermaceae, Rhamnaceae, Meliaceae, Lythraceae, Fabaceae, Sapindaceae, Combretaceae, Vitaceae, Myrtaceae, Euphorbiaceae, Passifloraceae, Polygalaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Lauraceae, Aristolochiaceae, Rutaceae, Loranthaceae, Rubiaceae, Commelinaceae, Orchidaceae, Cyperaceae and Poaceae	29
III	Preparation of dichotomous key for angiosperm families	6
IV	Analysis and identification of fresh and herbarium specimen of Angiosperms	13
V	Identification of names/family of photograph of the angiosperm specimen using online based software system	6
	Total	64Hrs
References	Reference Books: 1. Vashishta, K.M. 2008. Singa, A.K. and Singh, V.P. Algae. 9 <sup>th</sup> Edition. S. Chand & Company Ltd, New Delhi. . 2. Vashista, P.C., Sinha, A.K. and Kumar, A. 2006. Gymnosperms. Revised Edition. S.Chand & Company Ltd, New Delhi. 3. Vashista, P.C., Sinha, A.K. and Kumar, A. 2005. Pteridophyta. Revised Edition. S.Chand & Company Ltd, New Delhi. 4. Sharma, P.D. 2005. Fungi and Allied Organisms. Narosa Publishing House, New Delhi. 5. Johri, R.M. 2005. Taxonomy. Vols. I-IV, Sonali Publication, New Delhi. 6. Pathak, C. 2003. Latest Portfolio of Theory and Practice in Bryophyta. Dominant Publishers and Distributors, New Delhi. 7. Raven PH, Mertens TR. Plant systematics: theory and practice. BSCSPam. 1964-1965; 23:1-36. PMID: 5870805. 8. Sporne. K.R., 1976. Morphology of Pteridophytes. 4 <sup>th</sup> edition, B.I. Publication. 9. Gupta. M.N. 1972. The Gymnosperms (2 <sup>nd</sup> Edition) Shiva Lal Agarwal & Co., Agra. 10. Parihar. N.S. 1967. An introduction of Embryophyta. vol. III Pteridophyta. Central book depot, Allahabad.	

### M.Sc. Botany Syllabus (July 2021 onwards)

	<p>11. Sporne, K.R. 1950. Morphology of Gymnosperms. Hutchinson University Library, USA.</p> <p>12. Gamble, J.S. 1919-1925. The Flora of Presidency of Madras. Vol. I, II and III. Bishen Singh and Mahendra Pal Singh, Dehra Dun.</p>	
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>CO1: Evaluate and discuss groups of plants in terms of their diversity and describe their evolution, phylogeny.</p> <p>CO2: Apply the taxonomic principles in preparing keys and herbaria</p> <p>CO3: Acquire practical experience on identification of Angiosperms</p> <p>CO4: Provide skill to identify the lower plants with specific key characters</p> <p>CO5: Acquire practical knowledge on identification of various groups of plants</p>	

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	3
CO2	2	2	2	3	3
CO3	2	3	2	3	2
CO4	3	2	3	2	2
CO5	2	3	3	3	2

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Semester	<b>First</b>	CourseCode	<b>21BOTP0106</b>
CourseTitle	<b>PRACTICAL–II:ENVIRONMENTAL BIOLOGY</b>		
No.ofCredits	2	No.ofcontacthoursper week	4
NewCourse/ RevisedCourse	RevisedCourse	Ifrevised,Percentageof revision effected	25
Category	Core		
Scope of theCourse(may bemorethanone)	<ol style="list-style-type: none"> <li>1. OpportunitytounderstandthebasicconceptsofexperimentsinEnvironmentalBiology</li> <li>2. Exposureofstudentstoapproaches andtechniquesofEnvironmentalBiology</li> <li>3. Providingskillsto handletheexperiments inEnvironmentalBiology</li> </ol>		
Cognitive Levelsaddressed by theCourse	<b>K1</b> -Emphasistheimportanceofphysico-chemicalparametersin Environment <b>K2</b> -Understand thedifferent parametersoftheenvironment <b>K3</b> -Apply themethods of studyingthepopulation ofplants <b>K4</b> -Analyze the importanceofremotesensing, GISandEnvironmentalEducation <b>K5</b> -Evaluate the effectofindustrialeffluentsand pesticideson Organisms		
Course Objectives(Maximum:5)	TheCourseaims <ul style="list-style-type: none"> <li>• to estimate total solids, dissolved solids and suspended solids, dissolvedoxygen,carbondioxide,totalalkalinity,chloride,hardness,andturbidityindifferent watersamples</li> <li>• toknow theimportanceof BODand CODinpolluted watersamples</li> <li>• tounderstand howtostudy the populationofplants.</li> <li>• tounderstandhowtodesignbioassaystudiesonindustrialeffluents/pesticidesusing fish, aquaticinsectsand larvae.</li> <li>• toknowtheapplicationsofremotesensingandGIS</li> </ul>		
Unit	Content	No.ofHours	
1.	EstimationofTotalSolids,DissolvedsolidsandSuspended Solids.	3	
2.	EstimationofDissolvedoxygen	3	
3.	Estimationof Carbondioxide	3	
4.	EstimationofBOD&CODindifferentwatersamples (Demonstration).	6	
5.	Estimationof Total Alkalinity.	3	
6.	EstimationofChloride.	3	
7.	EstimationofTotalhardness.	3	
8.	EstimationofTurbidity	3	
9.	VegetativestudiesbylineQuadratandbeltransect methods	5	
10.	Calculationofbiodiversityindex	6	

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11.	Productivity of Aquatic ecosystems by planktons study Reagent Preparation	6 6
12.	CFA Record Work	10 4
	<b>Reference Books</b> 1. P.K.Gupta 2012 Methods in Environmental Analysis Water, Soil and Air. Agrobios (India), Jodhpur. 2. APHA 2012 Standard Methods for the examination of water and wastewater (20 <sup>th</sup> Edition). American Public Health Association, Washington. D.C.	
Course Outcomes	On completion of the course, students should be able to CO1 : Understand how to estimate Total Solids, Dissolved solids, suspended Solids, Dissolved oxygen, Carbon dioxide, Total alkalinity, Chloride, hardness, turbidity, BOD and COD in different water samples CO2: Understand how to study on population of plants. CO3: Understand the Bioassay studies on industrial effluents/pesticides using fish, aquatic insects and larvae. CO4: Understand the applications of remote sensing and GIS in environment. CO5: Know the methods of treating drinking and effluent water samples.	

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	1	1	1	1	1
CO4	3	3	3	3	3
CO5	3	3	3	3	3



## M.Sc.BotanySyllabus(July2021onwards)

### 21GTPP0001-GANDHI IN EVERYDAYLIFE

Credits:2

CFA:20+25+5

Total:50

#### Objectives:

- To understand and appreciate the principles and practices of Gandhi and their relevance in the contemporary times.
- To develop noble character and attitude to enable the students to cope up with the challenges of daily life.

#### Specific Objectives of Learning:

To enable students to:

- To understand the life and message of Gandhi in modernity.
- To know the Gandhian way of Management.
- To practice the Gandhian model of conflict resolution.
- To lead a human life on Gandhian lines.
- To become a Gandhian constructive worker.

**Unit 1 Understanding Gandhi:** Childhood days, Student days, influence of dramas, books, individuals, religions, family and social factors - Gandhian rebel, mimicking western civilization, acquaintance with vegetarianism, as a lawyer - encountering and transforming humiliation in India: with British Agent - in south Africa: train incident, Coach incident, on pathway, at court, attack by protesters - Gandhian political leader, social reformer and Constructive worker.

**Unit 2 Management:** Gandhi's experiments in managing family - Eleven vows - Managing Organizations - community living and financial ethics - Managing Social and political movements - Transvaal March - Non-cooperation movement and Salt Satyagraha - non-attachment to position.

**Unit 3 Conflict Resolution:** Pursuance of Truth and nonviolence - Rights and duties, Ends and means - Openness, love and kindness in handling relationship - nonviolent communication - nonviolent Direct Action (Satyagraha) and conflict Transformation - Conflict resolution practices in interpersonal relations, forgiveness and reconciliation - Shanti Sena.

**Unit 4 Humanism:** Trust in goodness of human nature - Respect for individual and pluralistic nature of society - equal regard for all religions (Sarvadharmā Samabhava) - simple and ethical life - swadeshi and unity of humankind.

**Unit 5 Sarvodaya:** Concept of Sarvodaya - Constructive Programmes - Gandhian alternatives to poverty, terrorism, environmental degradation, issues in education, science and technology, centralization of power and governance and health and hygiene.

## M.Sc.BotanySyllabus(July2021onwards)

### References:

M.K.Gandhi,*AnAutobiographyorTheStoryofMyExperimentswithTruth*,NavajivanPublishingHouse,Ahmedabad.

---.*SatyagrahainSouthAfrica*,NavajivanPublishingHouse,Ahmedabad.

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.*ConstructiveProgramme:ItsMeaningandPlace*,NavajivanPublishingHouse,Ahmedabad.

---.*KeytoHealth*,NavajivanPublishingHouse,Ahmedabad.

---.*DietandDietReform*,NavajivanPublishingHouse,Ahmedabad.

---.*BasicEducation*,NavajivanPublishingHouse,Ahmedabad.

---.*VillageIndustries*,NavajivanPublishingHouse,Ahmedabad.

---.*HindSwaraj*,NavajivanPublishingHouse,Ahmedabad.

---.*Trusteeship*,NavajivanPublishingHouse,Ahmedabad.

---.*IndiaofmyDreams*,NavajivanPublishing House,Ahmedabad.

Vinoba,*ShantiSena*,SarvaSevaSanghPrakashan,Varanasi.

V.P.Varma,*PoliticalPhilosophyofMahatmaGandhiandSarvodaya*,LakshmiNarainAgarwal,Agara.

LouisFisher,*Gandhi:HisLifeand Message*.

B.R.Nanda.*MahatmaGandhi:A Biography*,AlliedPublishersPrivateLtd.,NewDelhi.

N.K.Bose.*StudiesinGandhism*,NavajivanPublishingHouse,Ahmedabad.

GopinathDhawan,*ThePoliticalPhilosophyofMahatmaGandhi*,NavajivanPublishingHouse,Ahmedabad.

N. Radhakrishnan, *Gandhi's Constructive Programmes: An Antidote to Globalized Economic Planning?*, Gandhigram Rural Institute, 2006.

### WebLink:

- [www.mkgandhi.org](https://www.mkgandhi.org)[https://www.mkgandhi.org/ebks/gandhian\\_thought.pdf](https://www.mkgandhi.org/ebks/gandhian_thought.pdf)

### Films.

- RichardAttenborough,**Gandhi**.
- SyamBenegal,**Making ofTheMahatma**.
- AnupamP.Kher,**MeinGandhiKoNahinMara**.
- PeterAckermanandJackDuvall,**AForceMore Powerful**.

M.Sc.BotanySyllabus(July2021onwards)

Semester	<b>Second</b>	CourseCode	<b>21BOTP0207</b>
CourseTitle	<b>PLANTPHYSIOLOGYANDBIOCHEMISTRY</b>		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	RevisedCourse	If revised, Percentage ofrevisioneffected(Minimum 20%)	20
Category	Core		
Scope of theCourse (maybemorethanone)	1. Comprehendthemechanismof physiologyofplants 2. Realizetherole of biomoleculesin systemphysiology 3. Motivatethestudentstounderstandthebiochemistryandphysiologyofplantstobecome Plant Scientists		
CognitiveLevelsaddressedbythe Course	K1- Motivate to understand the basic and advancement of plant physiologyK2- Realize the various physiological and biochemical pathways of plantsK3- Understand the role of physiology and biochemistry in growth ofplantsK4- Gain the knowledge from this paper to appear national level competitiveexams K5-Utilizethetheknowledgeacquiredthrough this paperin various botanical researches		
CourseObjectives(Maximum :5)	<b>TheCourseaims</b> • Tounderstandthephysiologicalmechanismofplants • Tostudythevarious biochemicalpathways ofplants • Tocreate aknowledgeonphysiology anddevelopmental aspectsof plants • Toexplainthenitrogenmetabolisminplants • Toacquirethetheknowledgeon carbohydrates, enzymesandfat metabolism.		
Unit	Content	No.of Hours	
I	<b>Plant-water relations</b> Different Bio-physico-chemical phenomena; Diffusion; Imbibitions;Osmosis; Cell as an osmotic system Absorption and translocation ofwaterandminerals- Definition,pathway,mechanism,factor,significance Mineralnutrition- AbsorptiontheoriesMacroandMicronutrients - Source, function, deficiency symptoms; SolutionandsandcultureTranspiration- Definition,types,mechanism, factor,significance.	14	

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II	<p><b>Carbohydrate metabolism</b></p> <p>Photosynthesis-Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms CO<sub>2</sub> fixation-C<sub>3</sub>, C<sub>4</sub> and CAM pathways Respiration and photorespiration – Citric acid cycle Plant mitochondrial electron transport and ATP synthesis Alternate oxidase; photorespiratory pathway.</p>	14
III	<p><b>Nitrogen and fat metabolism</b></p> <p>Classification of protein based on source, shape, composition and solubility Essential and non-essential amino acids Nitrogen metabolism: NO<sub>3</sub>, NO<sub>2</sub> and NH<sub>3</sub> assimilation, biosynthesis of amino acids, nitrogen fixation Lipids: Classification, and importance, lipid metabolism-β Oxidation and Glyoxalate cycle.</p>	11
IV	<p><b>Enzymes</b></p> <p>Classification and nomenclature of enzymes: IUB, Isolation and purification of enzymes: Major classes of enzymes- Oxidoreductases, Transferases Hydrolases, Lyases, Isomerases and Ligases. Concept of active site, mechanism of enzyme action: Michaelis-Menten equation and Km value. Enzyme modifiers – activators, inhibitors, allosteric enzymes: Regulation of enzyme action: Isozymes – diagnostic applications.</p>	11
V	<p><b>Unit V</b></p> <p><b>Growth and development &amp; Stress physiology</b></p> <p>Plant hormones – Biosynthesis, storage, breakdown and transport; Physiological effects and mechanisms of action, Vernalisation, Photoperiodism and biological clocks, Sensory photobiology- Structure, function and mechanisms of action of phytochromes Cryptochromes and phototropins. Responses of plants to biotic (pathogen and insects) and abiotic (Stress physiology water, temperature and salt) stresses</p>	14
References	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Pandey, S.N. and Sinha, B.K. 2009. Plant Physiology. IV Edition, Vikas Publishing company, Noida, UP.</li> <li>2. Sinha, S.K. 2004. Modern Plant Physiology. Narosa publishing House, New Delhi, Chennai, Mumbai.</li> <li>3. Verma, S.K. 1995. A text book of Plant Physiology and Biochemistry. S.Chand &amp; Company Ltd. Ram Nagar, New Delhi.</li> <li>4. Taiz, L. and Zeiger, E. 2002. Plant Physiology, III Edition Sinauer Associates.</li> <li>5. Noggle, G.R. and Fritz, G.J. 2001, Introductory Plant Physiology, Prentice-Hall, India.</li> </ol>	

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	<p>6. Hopkins, W.G., 1999. Introduction to plant physiology (No. Ed.2).John Wiley and Sons.</p> <p>7. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A., 2015. Plantphysiology and development (No. Ed. 6). Sinauer AssociatesIncorporated.</p> <p>ReferenceBooks</p> <p>1.Devlin,R.M.,2000,PlantPhysiology,AffiliatedEastWestPress</p>	
	<p>Pvt.Ltd.</p> <p>2. Epstein,E.2000,MineralNutritioninPlants-PrinciplesandPerspectives.</p> <p>3. John Charles Walker,1997. Plant Physiology. McGraw Hill bookCompany,New York.</p> <p>4. DevlinandWitham,1996.PlantPhysiology.CBSPublishersandDistributors,Delhi.</p> <p>5. Mukhevji,S.andGhosh,A.K.1996.PlantPhysiology.TataMcGraw-Hill publishing Company Ltd. NewDelhi.</p> <p>6. HopkinsWG,NormanPA,Huner,2008.IntroductiontoPlantPhysiology.JohnWiley&amp; Sons, NewYork.</p> <p>13. JainVK,2008.FundamentalsofPlantPhysiology.SChandandCo.</p> <p>14. KochharPL,KrishnamoorthyHN.PlantPhysiology.Atmaramandsons, Delhi.</p> <p>15. MalikCP,2002.PlantPhysiology.Kalyanipublishers.</p> <p>16. MukherjiS,GhoshAK,2005.PlantPhysiology.NewCentralBookAgency, Culcutta.</p> <p>17. NoggleGR,FritzGJ,IntroductoryPlantPhysiology.PrenticeHallofIndia.</p> <p>18. PandeySN,SinhaBK,2006.Plantphysiology.VikasPublishingHouse,NewDelhi.</p> <p>19. SalisburyFB,RossCW,1992.PlantPhysiology.CBSpublishersandDistributors, NewDelhi.</p> <p>20. SinhaAK,2004.ModernPlantPhysiology.NarosapublishingHouse, NewDelhi.</p> <p>21. SrivastavaHS,2004.PlantphysiologyandBiochemistry.Rasthोगipublications.</p> <p>22. LincolnTaiz,EduardoZeiger,2015.PlantphysiologyandDevelopment(VI Edn).SinauerAssociatesInc.</p> <p>18. Noggle, G.R. and Fritz, G.J., 1983. Introductory plantphysiology (No. Ed.2). Prentice-Hall Inc.</p>	

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	<p>19 . Meyer, B.S., Anderson, D.B. and Bohning, R.H., 1960.Introductiontoplantphysiology.Introductiontoplantphysiology.</p> <p>20 .Curits, O.F. and Clark, D.G., 1951. An introduction to plantphysiology (Vol. 71, No. 1, p. 78).LWW.</p> <p>21. Taiz, L. and Zeiger, E., 1998. Plant Physiology pp.544-557 and564-571,2<sup>nd</sup> edition,SinauerAssociates, Sunderland,Mass.</p> <p>22. Dey P.M., Harborne J. B., eds. (1997) Plant Biochemistry,AcademicPress, San Diego.</p> <p>23. LeaP.J.,LeegoodR.C.1993.PlantBiochemistryandMolecular</p>	
	<p>Biology,Wiley.</p> <p>24. BuchananB.B.,GruissemW.,JonesR.J.2000.Biochemistryand Molecular biology of plants, American Society of PlantPhysiologists,M.D.</p> <p>25. Taiz and Zeiger.2002. Plant Physiology.pp.519-538, 3<sup>rd</sup> edition,SinauerAssociates,Inc.,Publishers.</p> <p>26.Davies, P.J ed. 1995. Plant Hormones and their Role in PlantGrowth and Development, pp. 118-139; 372-394;486-508,Kluwer,Dordrecht.</p> <p><b>Websources</b></p> <p><a href="https://www.easybiologyclass.com/plant-physiology-free-lecture-notes-online-tutorials-lecture-notes-ppts-mcqs/">https://www.easybiologyclass.com/plant-physiology-free-lecture-notes-online-tutorials-lecture-notes-ppts-mcqs/</a><a href="https://www.biologydiscussion.com/notes/plant-physiology-notes/lecture-notes-on-plant-physiology/34647">https://www.biologydiscussion.com/notes/plant-physiology-notes/lecture-notes-on-plant-physiology/34647</a></p>	
CourseOutcomes	<p>Oncompletionofthecourse, studentsshould beable todo</p> <p>CO1:Predictthephysiologicalphenomenaofplantsinterms ofmechanisms</p> <p>CO2:Identifytheoverviewofbiorhythms</p> <p>CO3: Critique the different metabolicathways</p> <p>CO4:Analysethenitrogenandlipidmetabolism</p> <p>CO5:ComparethestructureandmetabolismofPrimaryand Secondarybiomolecules.</p>	

**Mappingof Coswith PSOs**

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	3
CO2	3	2	3	2	2
CO3	1	1	1	1	1
CO4	3	2	3	3	3
CO5	2	3	3	2	2

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Semester	<b>Second</b>	CourseCode	<b>21BOTP0208</b>
CourseTitle	<b>ANATOMY,MORPHOGENESISANDEMBRYOLOGYOF ANGIOSPERMS</b>		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageofrevisionef fected(Minimum 20%)	30
Category	Core		
Scope of theCourse (maybemoret hanone)	<ol style="list-style-type: none"> <li>1. AcquiretheknowledgeonvariousaspectsofAnatomyandembryologyofAngiosperms</li> <li>2. Utilizetheknowledgeofthispapertosolvetheproblemsinootherbotanicalissues</li> <li>3. Make use of this knowledge for preparation of other competitiveexaminations</li> </ol>		
CognitiveLe velsaddresse dbythe Course	<p>K1- Motivate to understand the basic and advancement of plant anatomy andmorphogenesis</p> <p>K2-Realizethevarious aspectsof plantanatomy andembryology</p> <p>K3- Understand the role of anatomy and embryology to solve the issues inbotanicalsciences</p> <p>K4- Expand the knowledge acquired from this paper to utilize in national levelcompetitiveexams</p> <p>K5-Realizetheimportanceofplant anatomyinherbalmedicinespreparation</p>		
CourseObjecti ves(Maximum :5)	<p><b>TheCourseaims</b></p> <ul style="list-style-type: none"> <li>• Tounderstandtheanatomyofprimary andsecondarystructures</li> <li>• Toknowtheorganization, Structureandfunction ofmeristems</li> <li>• Tounderstandtheorganizationofshootandrootapical meristems</li> <li>• ToevaluatetheprocessofMicrosporogenesisandpollenddevelopment</li> <li>• Toacquiretheknowledgeonpollination andembryodevelopment.</li> </ul>		
Unit	Content	No.of Hours	
I	<b>Anatomy</b> Cell- structure and components;Organization and types of Tissue.Anatomy of root (Primary and Secondary Structure of Mono andDicots).Anatomy of Stem (Primary, Secondary structure of Monoand Dicots; and Anomalous Structure of <i>Boerhaavia</i> ). Anatomy ofthe leaf and petiole.Nodal Anatomy, Anatomy of Seed. Ecology inrelationtoAnatomy:briefnoteonadaptationofhydrophytes, xerophytesandhalophytes.	14	
II	<b>Morphogenesis</b> Plantmorphogenesis:Meristems–types;Organizationofshoot	12	

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	apical meristem; Theories of organization of meristems; Root - stem transition; Cambium: Origin, Structure and function, Factors affecting cambial activity; Wood: Structure, physical and mechanical properties, reaction wood, compression and tension wood, preservation of wood.	
III	<b>Morphogenesis and organogenesis:</b> Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in <i>Arabidopsis</i> and <i>Antirrhinum</i> . Molecular mechanisms of shoot & Root morphogenesis (Root Apical Meristem and Shoot Apical Meristem)	18
IV	<b>Embryology I</b> Microsporogenesis: Anther and Pollen development - Physiological relationship of tapetum and sporogenous tissues, pollen fertility, sterility, pollen storage and pollen germination. Megasporogenesis; Female gametophyte development, structure of pistil.	11
V	<b>Embryology II</b> Pollination; Pollen-Pistil interaction, Double fertilization; Endosperm types; Nuclear, cellular, helobial and ruminate endosperms. Development of monocot and dicot embryos Incompatibility; Methods to overcome incompatibility. Apomixis; genetics of Apomixis and polyembryony: Types and importance.	9
References	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Bhojwani, S.S. and Bhatnagar, S.P. 2008. The Embryology of Angiosperms. V Edition, Vikas publishing house Pvt Ltd., Noida, India.</li> <li>2. Gupta, P.K. 2002. Cytology, Genetics, Evolution and Plant breeding. Deep and Deep publications, New Delhi.</li> <li>3. Pandey, S.N. and Chadha, A. 2000. Embryology. Vikas Publishing House, New Delhi.</li> <li>4. Pandey, B.P. 1995. Embryology of Angiosperms. S. Chand &amp; Company Ltd., New Delhi.</li> <li>5. Pandey, B.P. Plant Anatomy, 2004. S. Chand &amp; Company Ltd., New Delhi.</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Kierman, J.A. 1999. Histological and Histochemical methods. Butterworth Publications, London.</li> <li>2. Fahn, A. 1989. Plant anatomy. Peragamon Press, Oxford, New York.</li> <li>3. Esau, K. 1987. The Anatomy of seed plants. Wiley Eastern Ltd, New Delhi.</li> </ol>	



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<ol style="list-style-type: none"> <li>4. Maheswari, P. 1950. An introduction to embryology of Angiosperms. McGraw hill, New York.</li> <li>5. Atwell, B.J. Kriedermann, P.E. and Jumbull, C.G.N. Plants in Action: Adaptation in Nature Performance, in Cultivation, MacMillan Education. Sydney, Australia, 1999.</li> <li>6. Bewley. J.D. and Black, M. Seeds: Physiology of Development and Germination, Plenum Press. New York, 1994.</li> <li>7. Bhojwani, S.S. Bhatnagar, S.P. and Dantu, P.K. The Embryology of Angiosperms (6<sup>th</sup> revised and enlarged edition). Vikas Publishing House, New Delhi, 2015.</li> <li>8. Burgess, J. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge, 1985.</li> <li>9. Fageri, K. and Vander Pijl, L. The Principle of Pollination Ecology. Pergamon Press, Oxford, 1979.</li> <li>10. Fahn, A. Plant Anatomy. (3<sup>rd</sup> edition). Pergamon Press, Oxford, 1982.</li> <li>11. Fosker, D.E. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego, 1994.</li> <li>12. Howell, S.H. Molecular Genetics of Plant Development. Cambridge University press, Cambridge, 1998.</li> <li>13. Leins, P., Tucker, S.C. and Endress, P.K. Aspects of Floral Development, J. Cramer, Germany, 1988.</li> <li>14. Lyndon, R.F. Plant Development. The Cellular Basis, Unwin Hyman, London, 1990.</li> <li>15. Murphy, T.M. and Thompson, W.E. Molecular Plant Development. Prentice Hall, New Jersey, 1988.</li> <li>16. Proctor, M. and Yeo, P. The Pollination of Flowers. William Collins Sons, London, 1973.</li> <li>17. Raghavan, V. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge, 1997.</li> <li>18. Raghavan, V. Developmental Biology of Flowering Plants. Springer-Verlag, New York, 1999.</li> <li>19. Raven, P.H., Evert, R.F. and Eichhorn, S. Biology of Plants (5<sup>th</sup> edition). Worth, New York, 1992.</li> <li>20. Salisbury, P.B. and Ross, C.W. Plant Physiology (4<sup>th</sup> edition). Wadsworth Publishing, Belmont, California, 1992.</li> <li>21. Steeves, T.A. and Sussex, I.M. Patterns in Plant Development (2<sup>nd</sup> edition). Cambridge University Press, Cambridge, 1989.</li> <li>22. Sedgely, M. and Griffin, A.R. Sexual Reproduction in Tree Crops. Academic Press, London, 1989.</li> <li>23. Shivanna, K.R. and Sawhney, V.K. Pollen Biotechnology for</li> </ol>	
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	<p>Crop Production and Improvement. Cambridge University Press, Cambridge, 1997.</p> <p>24. Shivanna, K.R. and Rangaswamy, N.S. Pollen Biology: A Laboratory Manual. Springer Verlag. Berlin, 1992.</p> <p>25. Shivanna, K.R. and Johri, B.M. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York, 1995.</p>	
Course Outcomes	<p>CO1: Analyse the structural elements of plants meristems, organogenesis and embryology</p> <p>CO2: Demonstrate the micro and megasporogenesis; sexual incompatibility, types of endosperm</p> <p>CO3: Outline the combined knowledge with special emphasis micro techniques.</p> <p>CO4: Evaluate the different modes of Pollination in Plants</p> <p>CO5: Critique the Knowledge on Primary and secondary anatomical Structure of plants.</p>	

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	3	3	2	3	3
CO3	1	1	1	1	1
CO4	3	3	2	3	3
CO5	3	2	2	2	3

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Semester	Second	CourseCode	21BOTP0209
CourseTitle	<b>CELLBIOLOGY ANDGENETICS</b>		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	RevisedCourse	If revised, Percentage ofrevisioneffected(Minimu m 20%)	50
Category	Core		
Scope of theCourse (maybemoret hanone)	1. UnderstandthevariousaspectsofCellbiologyandGenetics 2. Realizetheimportance ofstudyongeneticsinvarious health disorders 3. MotivatethestudentstounderstandthedifferentaspectsofCellbiologyandGeneti csto prepareforNational levelcompetitiveexaminations		
CognitiveLe velsaddresse dbythe Course	K1-Understandthebasic andadvancementofmoderngenetics K2-Realizeknowledge on organizationofgenesand chromosomes K3- Understand the role of genetics to solve the issues in botanical sciencesK4- Expand the knowledge on Cell biology and Genetics to utilize in nationallevelcompetitiveexams K5-Realizetheimportanceof Genetics inmedicalfiled		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> • Toevaluatethestructureofcellanditsvariousorganelles • Todemonstratetheorganizationofgenesand chromosomes • Toanalysethevariousaspectsoforganization of Chromosomes • Tocreatebroadknowledgeonbasicandrecenttrendsofgenetics • Toexplainthe structure ofCell signaling;Hormonesand theirreceptors.		
Unit	Content	No.of Hours	
I	<b>Structureof Cellandcellmembranes</b> Ultra structure of plant and animal cell; Membrane structure andfunction (Structure of model membrane, lipid bilayer and membraneprotein diffusion, osmosis, ion channels, active transport, membranepumps,mechanismsofsortingandregulationofintracellulartra nsport,electricalpropertiesofmembranes).Structuralorganizationandf unctionofintracellularorganelles;Cellwall,nucleus,mitochondria,Golg ibodies,lysosomes,endoplasmicreticulum,peroxisomes,plastids,vacu oles,chloroplast,structure& functionofcytoskeletonanditsroleinmotility.	13	
II	Organizationofgenesandchromosomes(operon,uniqueandreplicativeD NA,interruptedgenes,genefamilies,structureofchromatinandchromoso mes,heterochromatin,euchromatin,transposons).Celldivisionandcellc ycle;Mitosisandmeiosisregulationandcontrolofcellcycle- positive(cyclinsandcyclin- dependentkinases)andnegativeregulation(retinoblastomaprotein	13	

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	(Rb),p53,andp21).Geneticsandcancer:Differencesbetweennormal and cancer cell- Oncogenes- tumor inducing retroviruses andviraloncogenes--Environmentalfactors inducingcancer.	
III	<b>Cellsignaling</b> Cell signaling; Hormones and their receptors, cell surface receptor,signaling through G-protein coupled receptors, signal transductionpathways,secondmessengers,regulationofsignalingpathw ays,bacterial and plant two component systems, light signaling in plants,bacterial chemotaxis and quorum sensing. Cellular communication;Regulationofhematopoiesis,generalprinciplesofcellc ommunication,celladhesionandrolesofdifferentadhesionmolecules,ga pjunctions,extracellularmatrix,integrins, neurotransmissionanditsregulation.	14
IV	<b>Mendeliangenetics</b> Mendelianprinciples:Domiance,segregation,independentassortment : Codominance, incomplete dominance, gene interactions,pleiotropy,genomicimprinting,penetranceandexpressivit y,phenocopy, linkage and crossing over, sex linkage, sex limited andsex influenced characters. Concept of gene : Allele, multiple alleles,pseudoallele,complementationtests.Genemappingmethods:Li nkagemaps,tetradanalysis,mappingwith molecularmarkers,mapping by using somatic cell hybrids, development of mappingpopulationinplants.Eugenics-humanbetterment;Sex determinationandSexlinkedinheritance.	12
V	<b>ExtrachromosomalinheritanceandHumangenetics</b> Extra chromosomal inheritance: Inheritance of Mitochondrial andchloroplastgenes,maternalinheritance.Cytoplasmicinheritance;Pr edetermination - Virus like inclusions and infective particles, milkfactor,kappaparticles,plastidinheritance,maternalinheritance.Str ucturalandnumericalalterationsofchromosomes:Deletion,duplication, inversion,translocation,ploidyandtheirgeneticimplications.Humange netics:Pedigreeanalysis,lodscoreforlinkage testing, karyotypes, genetic disorders. Quantitative genetics :Polygenicinheritance,heritabilityanditsmeasurements,QTL mapping.	12
References	<b>TextBooks:</b> 1. SundaraRajan,S.2003.IntroductiontoCellBiology.VikasPublishin gHousePvt. Ltd., New Delhi. 2. Nair,P.K.G.andPrabhakarAchari,K.1999.ATextBookofCellBiolog y.Konark Publishers Pvt. Ltd., Delhi 3. Verma,P.S.andAgarwal,V.K.2004.Cellbiology,Genetics,	

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	<p>MolecularBiology,EvolutionandEcology.S.Chand&amp;CompanyLtd.New Delhi.</p> <p>4. GuptaandJains,1991.TheCellandBiotechnology,1<sup>st</sup>Edition,AgroBotanical Publication, New Delhi.</p> <p>5. BenjaminA.Pierce.2012.Genetics-AconceptualApproach. W.H.FreemanandCompany,NewYork,England.ReferenceBooks</p> <p>1. EldonJ.Gardner.2004.PrinciplesofGenetics8<sup>th</sup>edition,JohnWileyand Sons, New York.</p> <p>2. Giese,A.C.1999.CellPhysiology.5<sup>th</sup>Edition,W.B.SoundersCompany.</p> <p>3. Chariotte J. Averse. 1995.Molecular Cell Biology.AddisionWesley Publ. Co. Gerald Karp, Cell Biology, II Edition – McGrawHillInternationalBook Co., NewDelhi</p> <p>4. Edmund,W.Sinnott,L.C.DunnandDobzhansky,T.1990.Principles ofGenetics,5<sup>th</sup> edition, Tata McGraw Hill PublishingCompanyLtd., New Delhi.</p> <p>5. Goodenouth, U. 1984, Genetics 3<sup>rd</sup>edition CBS CollegePublishing,Halt,Rineshait and Winstion.</p>	
CourseOutcomes	<p>Oncompletionofthecourse, studentsshould beable todo</p> <p>CO1:Explainthestructureandfunctionofcellanditsorganelles</p> <p>CO2:Understand the Mechanism ofCell signaling</p> <p>CO3:CompareknowledgeonCelldivision andcellcycle</p> <p>CO4:Analysethevariousfactorsdeterminingtheheredityfromonegenerationto another</p> <p>CO5:Critiquethe mechanism ofSex determinationin organisms.</p>	

#### Mappingof Coswith PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	3	2	3	2	3
CO3	1	1	1	1	1
CO4	3	2	2	3	2
CO5	2	2	3	3	2

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CourseCode, Title &Credits	<b>BIOSTATISTICS</b>			<b>21BOTP0210</b>	<b>Credits-4</b>
Class	M.Sc.Botany	Semester	Second		
Cognitive Level	K- 1Knowledge,comprehensionK- 2Application K-3Analysis,synthesis,evaluation				
CourseObjectives	TheCourseaims <ul style="list-style-type: none"> <li>• to create graphs and diagrams using statistics to communicate important information about the data</li> <li>• to introduce sampling and its feature in biological investigations</li> <li>• to describe sample characteristics using central and dispersion measures</li> <li>• to familiar with relational measures and the relevance and need for regression analysis</li> <li>• to understand the biological measures such as rates, incidence, prevalence and their interpretations</li> </ul>				
<b>UNITS</b>	<b>Contents</b>				<b>No.of Hours</b>
<b>I</b>	<b>Introduction to Biostatistics:</b> Development of Biostatistics and its applications - Sources of biological data - Secondary and Primary sources-Classification and tabulation of data-frequency distribution-Diagrammatic and Graphical representation of statistical data.				<b>12</b>
<b>II</b>	<b>Sampling Techniques:</b> Meaning - Advantages, concept of parameter and statistics, sample size, sampling error, sampling frame. Types of samples-Probability sampling-simple, systematic, stratified, cluster, multi-stage sampling. Non-probability sampling-Purposive, Convenience, Judgment and snowball techniques.				<b>13</b>
<b>III</b>	<b>Descriptive Statistics:</b> Measures of central tendency-Mean, Median, Mode-Measures of Dispersion:- Range, Quartile Deviation, Mean Deviation, and Standard Deviation. Absolute and relative measures of dispersion. Skewness and kurtosis measures.				<b>13</b>
<b>IV</b>	<b>Correlation and Regression Analysis:</b> Definition, uses, types of correlation, Regression Lines- Properties of regression lines and coefficients; Introduction to probability and its applications-Theoretical Distributions-Binomial, Poisson, and Normal distributions; Properties, uses and applications.				<b>13</b>

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<b>V</b>	<b>InferentialStatisticsandBiologicalMeasures:Hypothesistesting andTestsofsignificance-Testofattributes,smallandlargesampletests- Analysisofvariance–one-wayandtwo-wayclassifications;</b>	<b>13</b>
	Measurementofrisk,oddsratioandBioassayanddoseresponses.	
References	<ul style="list-style-type: none"> <li>• Gupta.C.B,AnIntroductiontoStatisticalMethods,NewDelhi:VikasPublishers,(23<sup>rd</sup>Ed), 2004.</li> <li>• Gupta.S.P,StatisticalMethods,NewDelhi:SultanChand,2017.</li> <li>• Hogg. R.T. and A.T. Craig. A.T, Introduction to mathematical Statistics, (7<sup>th</sup>Ed),2012.</li> <li>• Rangaswamy,ATextbookofAgriculturalStatistics,(3<sup>rd</sup>Ed),NewAgeInternationalPublishers,New Delhi, 2020.</li> <li>• Rohatgi,V.K.andA.K.md.EhsanesSaleh(2009)AnIntroductiontoProbabilityTheoryandMathematicalStatistics,2<sup>nd</sup>Edition,WileyEasternLimited,New Delhi.</li> <li>• Qazi Shoeb Ahmad, Viseme Ismail, Biostatistics, University Science press, newDelhi,(1<sup>st</sup>Edition), 2008.</li> <li>• SampathKumarV.S;Bio-Statistics,ManomaniamSundaranarUniversityPublication,Tirunelveli, 1997.</li> <li>• VermaB.L,ShuklaG.DandSrivastava.R.N,Biostatistics–PerspectivesinHealth Care; Research and Practice, New Delhi: CBS Publishers &amp; Distributors,1993.</li> <li>• W.G.Cochran,SamplingTechniques,WileyEasternLtd,NewDelhi,(1985).</li> <li>• <a href="https://www.biostat.washington.edu/about/biostatistics">https://www.biostat.washington.edu/about/biostatistics</a></li> <li>• <a href="http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_BiostatisticsBasicshttps://www.edx.org/course/biostatistics-0">http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_BiostatisticsBasicshttps://www.edx.org/course/biostatistics-0</a></li> </ul>	
CourseOutcomes	<p>Oncompletionofthecourse, studentsshouldabletodo</p> <p>CO1:Carryoutdataanalysis usinggraphs/diagramsandmakeinterpretationsuitably.</p> <p>CO2:Identifysamplesurveysinbiologicalresearchandportraysamplefeaturesusingappropriatestatistics</p> <p>CO3 : Describe sample characteristics using central and variability measuresCO4:Analyzecorrelationbetweenvariablesinterpretationbesidesregression analysisforestimationproduction</p> <p>CO5:Computethebiologicaldatawith appropriaterates andratios</p>	

**Mappingof COSwithPSOs & POs**

CO \ PSO	PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		2	2	1	2	2
CO2		2	2	1	2	2
CO3		2	2	1	2	2
CO4		2	2	1	2	2
CO5		2	2	1	2	2

M.Sc.BotanySyllabus(July2021onwards)

Semester	<b>Second</b>	CourseCode	<b>21BOTP0211</b>
CourseTitle	<b>PRACTICAL-III:PLANT PHYSIOLOGY &amp; BIOCHEMISTRY,ANATOMYANDEMBRYOLOGYOF ANGIOSPERMS</b>		
No.ofCredits	1	No.ofcontacthoursper week	4
NewCourse/ RevisedCourse	RevisedCourse	If revised, Percentage of revisioneffected(Minimum 20%)	45
Category	Core		
Scope of theCourse (maybemorethanone)	1. Comprehendthemechanismof physiologyofplants 2. Realizetherole ofbiomoleculesinsystem physiology 3. Motivatethestudentstounderstandthebiochemistryandphysiologyofplantstobecome Plant Scientists		
CognitiveLevelsaddressedbythe Course	K1-Motivateto understandvarious techniques ofplantphysiology K2- Realize the various physiological and biochemical pathways of plants bydifferenttechniques K3- Understand the role of physiology and biochemistry in growth ofplants K4- Gain the knowledge from this paper to improve the laboratory technicalknowledge K5-Utilize the knowledge acquired through this paper in various botanicalresearches		
CourseObjectives(Maximum :5)	<b>TheCourseaims</b> •Todeveloptheskillsonquantitativeandqualitativeanalysisofvariousbiochemicalcomponentsof plants •To estimate the various biochemicals and their importance to the physiology ofplants •Tounderstandthevarious physiologicalmechanismofplants. •Toanalysetheroleofbiochemicalsinthephysiologicalmechanism ofplants. •Toevaluatethe usageofvariousinstrumentsin plantphysiology.		
Experiment no.	Content	No.of Hours	
1.	Determinationofosmoticpotentialofcellsapbyplasmolyticmethod	4	
2.	Isolation of enzyme (amylase/ xylanase) from germinating fingermilletseeds and estimatingcrudeenzyme activity.	6	
3.	Estimationoftotalcarbohydratesinplanttissues(sugars/starch)	6	
4.	Estimationofproteinand lipidin planttissues	6	
5.	Extractionofchloroplastpigmentsfromleavesandpreparationoftheabsorption spectrumofchlorophylls and carotenoids		
6.	Extractionanddeterminationofchlorophylla/chlorophyllbratioinC3and C4 plants.	6	
7.	Separationofanthocyaninsbypaperchromatographyandthinlayerchromatography	6	
8.	Extractionandestimationofleghaemoglobinfromroot nodules	5	
9.	Bioassayof IAA andGA3	4	



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10.	Determination of catalase and peroxidase activity by Chance and Maehly (1955).	4
11.	Estimation of total phenolics	4
12.	Effect of hormones on seed germination and seedling establishment	5
13.	Anatomical sections of Monocot and dicot stem and Root Anatomical sections of leaf and meristem	4
14.	Observation of monocot and dicot embryos	4
References	<p><b>Text Books:</b></p> <p>1. Palanivelu, P. 2009. Analytical biochemistry and separation techniques. IV Edition Twenty first century publication, Madurai.</p> <p>2. Sawhney, S.K. and Randhir Singh, R. 2000. Introductory Practical Biochemistry Narosa Publishers, New Delhi.</p> <p><b>Reference Books</b></p> <p>3. Harborne, J.B., 1998. Phytochemical Method. Springer (India) Pvt. Ltd., New Delhi, 1998.</p> <p>4. Bhattacharya, D. 2003. Experiments in Plant Physiology, Narosa Publishing House, New Delhi.</p> <p>5. Sadasivam, S. and Manickam, A. 1992. Biochemical Methods for Agricultural Science. Wiley Eastern Limited, New Delhi.</p> <p>6. Mannar Mannan, R. 1989. A Short Term Course Manual in Plant Physiology for College Teachers. Madurai Kamaraj University, Madurai.</p>	
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>CO1: Analyze the biochemical components of any plant samples</p> <p>CO2: Explain the photosynthetic mechanism and related events of plants</p> <p>CO3: Demonstrate the role of various growth promoting substances and their action</p> <p>CO4: Evaluate the knowledge on physiological response of plants to various factors</p> <p>CO5: Identify the role of biochemicals in the physiological mechanism of plants.</p>	

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2
CO2	3	3	3	3	2
CO3	1	1	1	1	1
CO4	3	3	2	3	3
CO5	3	2	2	2	2

M.Sc.BotanySyllabus(July2021onwards)

**21ENGP00C1–COMMUNICATIONAND SOFTSKILLS**  
**(Soft Skills Course – Compulsory Non Credit course –**  
**2Credits -2 Hours/wk.)**

**(ForallPGstudentsexceptMAECSstudents)**

**Objectives:**

- Tohelpthestudentsimprovetheircommunicationandlifeandsoft skills;and
- Toenhancetheirpersonalityandemployabilityskills.

**UNITI**

- BasicsofCommunication
- BarrierstoCommunication

**UNITII**

- CommunicationandLanguageSkills
- CommunicatinginaGlobalLanguage

**UNITIII**

- ResumesandCoverLetters
- GroupDiscussions

**UNITIV**

- Businesscommunication
- InterculturalCommunication

**UNITV**

- ProfessionalCommunication
- Interviews

**Textbook:**

Krishnaswamy, Dhariwal and Krishnaswamy. *Mastering Communication Skills and Soft Skills*.Blomsbury, 2015.

**Assessment:ThereisnoESE.Assessmentistotallyinternaland isperformance-based.**

M.Sc.BotanySyllabus(July2021onwards)

Semester	<b>Third</b>	CourseCode	<b>21BOTP0313</b>
CourseTitle	<b>BIOINSTRUMENTATION</b>		
No.of Credits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageofrevisionef fected	20
Category	Core		
Scope of theCourse (maybemore thanone)	1.Facilitatethestudentstounderstandtheinstrumentationtechniques2.L earning the fundamental and working principles of instruments3.Understandtheconceptofresearch methodology.		
CognitiveLe velsadresse dbythe Course	K1-Enrich theknowledgein thefield of bioinstrumentation K2-GainingfactualideasinbioinstrumentationandresearchmethodsK3- Applicationofrecentinstrumentationtechniques inresearch K4- Focus on the working principles of instruments in the field of BiologyK5-Developingcompetenceandwritingskillsof thesisandpublications K6-Promoteandestablish theresearchactivitiesin thefieldofZoology		
CourseObject ives(Maximu m:5)	TheCourseaims <ul style="list-style-type: none"> <li>• Tounderstandtheprinciplesandapplicationsofordinaryand electronmicroscopes</li> <li>• Tolearnthetechniquesinisolaton andseparationofcellorganelles,micro andmacromolecules.</li> <li>• ToimbibetheprincipleandapplicationsofElectrophoresis,colorimetryandcalor imeter</li> <li>• Tounderstandtheresearchmethods,thesiswritingandpresentation</li> <li>• Tolearnthearticlepublication,ethicsand IPR.</li> </ul>		
Unit	Content	No.of Hours	
I	<b>Microscopy,pH and Buffer</b> Microscopy- Principle and Applications- Light, phase contrast, ConfocalandFluorescence–ElectronMicroscopy- SEMandTEM(Source:NPTEL)-pHbasicprinciples–pHelectrodes- Principles,application andpreparationofcommonbuffers-Citrate, acetate, tris andphosphate	11	

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II	<p><b>IsolationandSeparation</b> Isolationofcellularconstituents- Chloroplasts,mitochondria,nucleicacidsandenzymes-Homogenization- Manual,mechanicalandsonication-Centrifugationtechniques- Basicprinciples,Differenttypesof Centrifuges, Analytical and preparative ultracentrifugation methods(Source: NPTEL) – Chromatography- Paper, thin layer, Ion-exchange,column-separationofaminoacidsandsugars- Gasliquid chromatography,GC-MS,HPLC.</p>	13
III	<p><b>Electrophoresis,ColorimetryandCalorimeter</b> Electrophoresis- GeneralPrinciplesHorizontal&amp;Verticalgelelectrophoresisandimmunelect rophoresis(Source:NPTEL)-Electrophoresis of proteins and nucleic acids- Spectroscopic techniques-UV-VisibleandFT-IR– Flamephotometer,Bombcalorimeter,AAS, MassSpectra,NMR –Principleandapplications.</p>	13
IV	<p><b>Research,ThesiswritingandPresentation</b> Research-Definition,objectives,typesandimportance- ResearchmethodsinBiologicalSciences-Researchprocess- Literatureandreference collection – sources- Role of Libraries in research-e-journalsand e-books- Scientific databases-Indexing data bases, Citation databases: Web of Science, Scopus, Google Scholar- Research report writing-PartsofThesisandDissertation- Presentationinseminarsandconferences</p>	13
V	<p><b>ArticlePublication,EthicsandIntellectualPropertyRights</b> Writing scientific paper- Organization of scientific paper- Publication inresearchjournals-StandardsofResearchjournals-Peerreview-Types- Impactfactor-citationindex,h-index,i10index-Preparationofmanuscript- Proofcorrection-proofcorrectionsymbols-Methodofcorrecting proof- Plagiarism checking-Use of plagiarism softwares–Preparation of Research proposal and funding agenciesand Researchfellowships- Ethics in research-Plants and animals - Intellectual PropertyRights- OriginandhistoryofIndianPatentsystem-Basisof patentability-Patentapplicationprocedurein India.</p>	14
References	<p><b>TextBooks</b> 1. L.Veerakumari.2019.Bioinstrumentation.MJP Publishers, Chennai.pp.39-98;113-153;185-375. 2. C.R. Kothari and Gaurav Garg.2019. Research Methodology- Methods andTechniques.New Age International Publishers, NewDelhi.pp.1-25. 3. Biju Dharmapalan 2012 Scientific Research Methodology. NarosaPublishingHouse,NewDelhi. 4. N.Gurumani2010ResearchMethodologyforBiologicalSciences.MJPPubli shers,Chennai.</p>	

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	<p>5. S.PalanichamyandM.Shunmugavelu2009.Researchmethodsinbiologicalscienc es.Palani paramount publications, Palani</p> <p><b>ReferenceBooks</b></p> <p>1. Sahu,P.K.2013.ResearchMethodology:AGuideforResearchersinAgriculturalScien ce,Social Scienceand otherrelated fields. Springer,New Delhi.</p> <p>2. K.Kannan2003Hand bookofLaboratoryculturemedia,reagents,stainsandbuffersPanima publishing corporation, New Delhi.</p> <p>3. Keith Wilson and John Walker 2002 Practical biochemistry – Principles andtechniques.Fifth Edn.CambridgeUniv. Press.</p> <p>4. P.Asokan2002.Analyticalbiochemistry–Biochemicaltechniques.</p>
	<p>FirstEdition –Chinnaapublications,Melvisharam,Vellore</p> <p>5.RodneyBoyer2001ModernExperimentalBiochemistry.IIIEd. AddisonWesleyLongmanPte. Ltd, IndianBranch,Delhi, India.</p> <p><b>E-Resources</b></p> <p>1. <a href="http://nptel.ac.in/syllabus.php?subjectId=102107028">http://nptel.ac.in/syllabus.php?subjectId=102107028</a>.2.<a href="http://b-ok.xyz/book/674611/288bc3">http://b-ok.xyz/book/674611/288bc3</a></p> <p>3. <a href="http://www.researchgate.net/publication/317181728-LectureNotesonLaboratoryInstrumentationandTechniques">http://www.researchgate.net/publication/317181728-LectureNotesonLaboratoryInstrumentationandTechniques</a>.</p> <p>4. <a href="http://iiscs.wssu.edu/drupal/node/4673">iiscs.wssu.edu/drupal/node/4673</a></p> <p>5.<a href="http://www.studocu.com/en/search/researchmethodology?languages=language_en&amp;type=document">http://www.studocu.com/en/search/researchmethodology?languages=language_en&amp;type=document</a></p> <p>*(NPTEL)-NationalProgrammeonTechnologyEnhancedLearning.</p>
CourseOutcomes	<p>Oncompletionofthecourse, studentsshouldbe ableto</p> <p>CO1: Enabling the students to understand the principles and applications ofdifferenttypes of microscopes,pH meterandbuffers.</p> <p>CO2:Providingexcellencein isolationandseparationtechniques.</p> <p>CO3:Enhancethe applicationandseparationtechniquesofvariousmicro andmacromolecules</p> <p>CO4:Explainthebasicinformationonresearchmethods</p> <p>CO5:Createawarenessontheimportanceof articlepublicationandIPR.</p>

#### Mapping of Cos with PSOs

PSQ	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	2	3	3	2
CO3	3	3	3	3	3
CO4	3	2	3	3	3
CO5	2	3	3	3	2

M.Sc.BotanySyllabus(July2021onwards)

Semester	<b>Third</b>	CourseCode	<b>21BOTP0314</b>
Course Title	<b>PLANT RESOURCE UTILIZATION &amp; BIODIVERSITY CONSERVATION</b>		
No.of Credits	4	No.ofcontacthoursper week	4
NewCourse/Revised Course	RevisedCourse	If revised, Percentage ofrevision effected (Minimum20%)	50
Category	Core		
Scope ofthe Course(may bemorethan one)	1. Facilitate the students to understand the economic importance of plants andBiodiversity 2. Understandingthevariousissues relatedwithbiodiversity andclimatechange 3. Acquire the knowledge on Economic botany and Biodiversity to prepare forvariouscompetitive examinations		
Cognitive Levelsaddressedby theCourse	K1-Enrich theknowledge economicimportanceofdifferent plants K2-GainingfactualideasonoriginanddiversityofdomesticatedplantsK3- Understanding the values, threats and the strategies of biodiversityconservation K4-Realizethecurrentmethodsofbiodiversityandconservation K5- Understanding the value of this course to utilize for various botanical researchissues		
CourseObjectives(Maximum:5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Toknowthe economicimportanceof differentplants</li> <li>• Tounderstandtheoriginanddiversityofdomesticatedplants</li> <li>• Toexplain thevarious threatsof biodiversity andthestrategiesfor conservation</li> <li>• Toevaluatethestatus ofBiodiversityofIndiaandlossofbiodiversity</li> <li>• Toidentifythecurrentpracticesofbiodiversity conservation</li> </ul>		
Unit	Content	No.of Hours	
I	<b>EconomicBotany I</b> Botanicalname,family,morphologyofusefulpartandusesofCereals -Paddy,wheat,maize;Millets:Minormilletsmajormillets-Sorghum,Ragi,rye;Legumes-Blackgram,pigeonpea,greengram;Nuts-Groundnut,cashewnut,almond;Vegetables-Tomato,carrot,cabbage;Fruits-Apple,mango, datepalm; Fibers-Cotton, jute.	13	

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II	<p><b>Economic Botany II</b>            Botanical name, family, morphology of useful part and uses of Wood - Teak, rose wood; Essential oil - Sunflower oil, Groundnut oil, Sesameoil; Spices and condiments - Cinnamon, Pepper, Cardamom, Nut-meg, Clove, Turmeric, Chillies; Beverages- Coffee, Cocoa; Tannin- Myrobalan; Latex - Rubber; Dyes - Indigo, Henna; Gum - Gum arabic; Sugars- Sugarcane; Fumigatory and mastigatory – Tobacco, Arecanut.</p>	12
III	<p><b>Biodiversity Status and Loss</b>            Basic concepts of biodiversity, levels and types; values of biodiversity - evolutionary, economic, social, cultural and intrinsic values, biodiversity hotspots, their characteristic flora and fauna, Biodiversity resources of the Western Ghats of India, IUCN red list categories; threat to biodiversity - Indian context, important threatened/ endemic plant and animal taxa of India, biodiversity and ecosystem services; Climate change and biodiversity; Threatened categories, biological invasions and Biodiversity.</p>	12
IV	<p><b>Status and Management of Biodiversity</b>            Global approaches to biodiversity conservation, Indigenous approaches to biodiversity conservation, biodiversity &amp; ethnomedicinal resources, Indian initiatives in biodiversity conservation - biodiversity act 2002, Biodiversity Rules 2004, national biodiversity strategy and action plan (NBSAP), Plant Varieties Protection and Farmer's Rights Act, 2001. Indian case studies on conservation and management strategies (Project Tiger, Biosphere reserves).</p>	12
V	<p><b>Conservation of Biodiversity</b>            History of biodiversity conservation; Biodiversity conservation strategies: <i>in situ</i> conservation case studies: Biosphere reserve (NBR), sanctuaries, national parks, <i>ex situ</i> conservation: botanical garden, zoological park, <i>in vitro</i> conservation: germplasm or gene bank, tissue culture; National biodiversity authority (NBA) etc; protected area network (PAN) - biosphere reserves, Hotspots in the world, Tiger Reserve (Anamalai Tiger Reserve) national park (Silent valley), sanctuary (Megamalai Wildlife Sanctuary), community conservation area (Ayyalur RF); important protected areas of the Western Ghats of India.</p>	15

### M.Sc.BotanySyllabus(July2021onwards)

References	<p><b>TextBooks:</b></p> <ol style="list-style-type: none"> <li>1. Kochhar, S.L. 2011. Economic Botany in the Tropics. IV edition. Macmillan Publishers India Pvt. Ltd. New Delhi.</li> <li>2. Bawa K. S., Primack, R. V. and Oommen, M. A. 2011. Conservation biology: A Primer for South Asia, ATREE, Bangalore.</li> <li>3. Krishnamurthy, K. V. 2003. An advanced textbook on Biodiversity, Oxford and IBH Publishing Co. Pvt Ltd. New Delhi.</li> <li>4. Swaminathan, M. S. and Cocchar S. L. (Eds) 1999. Plants and society. Mac Millan Publications Ltd. London.</li> <li>5. Sambamurthy, A. V. S. S. and Subramanian, N. S. 1999. A text book of Economic Botany, Wiley Eastern Limited, New Delhi.</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Pandey, B. P. 1998. Economic Botany, S. Chand &amp; Co., New Delhi.</li> <li>2. Frankel, O. H. Brown and Burdon, J. J. 1995. The conservation of plant diversity. Cambridge University Press, Cambridge.</li> <li>3. Hill, F. A. 1952. Economic Botany: A text book of useful plants and plant products, Tata McGraw Hill Publishing Co., Ltd., New Delhi.</li> </ol>	
Course Outcomes	On completion of the course, students should be able to do	
	<p>CO1: Identify the economically important plants with binomial names, family &amp; uses and strategies for green revolution</p> <p>CO2: Analyse the biogeography, status and loss of biodiversity, initiatives for biodiversity conservation</p> <p>CO3: Create knowledge on biodiversity management, role of biotechnology, organization involved, ITR, IPR and biopiracy.</p> <p>CO4: Identify the current practices of biodiversity conservation</p> <p>CO5: Design the principles of conservation, major approaches on management, Indian case studies on conservation</p>	

#### Mapping of Cos with PSOs

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	2	3	3	2
CO3	3	3	3	3	3
CO4	3	2	3	3	3
CO5	2	3	3	3	2



M.Sc.BotanySyllabus(July2021onwards)

Semester	Third	CourseCode	21BOTP0315
CourseTitle	<b>FORESTECOLOGY,PHYTOGEOGRAPHYANDREMOTESENSING</b>		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	NewCourse	Ifrevised,Percentageof revision effected (Minimum20%)	-
Category	Core		
Scope of theCourse (maybemoret hanone)	1. Understandthe conceptsof ForestEcology 2.RealizethefactsofForestEcosystemFunction&Dynamics 3. MotivatethestudentstoappearcompetitiveexaminationsinthefieldofForestry		
CognitiveLe velsaddresse dbythe Course	K1- Expose the knowledge on Forestry related sciencesK2-Realizetheimportanceof forestandotherresources K3-UnderstandthevariousphytogeographicalregionsofWorldK4- Incorporatetheknowledgeof forest ecosystems K5-Integratetheknowledgeobtainedfrom thispapertobecome forest conservationist.		
CourseObjecti ves(Maximum :5)	TheCourseaims toknowthebasicfactsofForestecologyanditsassociatestoacqui reknowledgeonForest ecosystemandNWFP tosurveyandanalysethe various phytogeographicalregions ofWorld tounderstandtherole of remotesensingin forestsurveyandconservationtorealizetheimportanceofforest ecosystemfunction & dynamics.		
Unit	Content	No.of Hours	
I	<b>IntroductiontoForest Ecology</b> Forest ecology: History, scope, principles and concepts; ecology oftropicalandtemperateforests;Generalintroductiontoforest;Classifica tionofIndianforests:Tropical,temperate,evergreen,semi-evergreen, deciduous, monoculture, social, industrial; Factorsaffectingvegetation:Localityfactors,climaticfactors,edaphicfa ctors,ecologicalandphysiographicfactors,bioticfactors,influenceofpla ntcompetition,parasites,epiphytes,climber-weeds onforests.	13	

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II	<p><b>Useandmisuseofforests byman&amp;Forest dynamics</b></p> <p>Stronginterrelationshipsbetweenforestandecosystem:Forestgenetics,forestryphysiology,foresteology;Macrodynamicecosystem reserves, hydrological cycles; Importance and value ofwoodandNon-woodforestproducts(NWFP);Majorandminor</p>	13
	<p>forestproducts;Animalandhumanconflictmanagement,Useand misuseofforestsbyman,directandindirectforestwealth;forestprotection through peoplecommittee.</p>	
III	<p><b>ForestEcosystemFunction:</b>Primaryproductivityofforesteosystems; methods of measurement; productivity patterns; litterproductionanddecomposition;nutrientcyclingandnutrientconservationstrategies;foresthdrology;Measurementofforestproductivity;EcologicalSuccession;Forestdisturbances;Forestfragmentation.SpeciesInteractions:Typesofinteractions,interspecificcompetition,herbivory,carnivory,pollination, symbiosis.</p>	12
IV	<p><b>Plantgeography&amp;distributionofvegetations</b></p> <p>Principles and importance of plant geography; static and dynamicphytogeography;Geologicalhistoryandevolutionofplantlife;factors affecting plant distribution; different types of distribution ofvegetations on the earth; Patterns of plant distribution: continuousdistribution- circumpolar, circumboreal, circum austral, pan tropicalanddiscontinuousdistribution-Theoryoflandbridges,Wegner's theoryoftheory of continental drift, theory of glaciation;</p>	12
V	<p><b>Remotesensing and GISmapping</b></p> <p>Introduction to Remote Sensing. The electromagnetic spectrum,Energy instruction with atmosphere and earth surface, satellite and sensors,Remotesensingdataacquisition.Principlesandbasicconcepts ofMultispectral,ThermalandhyperspectralScanning:Across-track and Along Track multispectral Scanning. History ofSpace Imaging Image Interpretation: Type of Imagery, elements of Interpretation,TechniquesofVisualInterpretation,Roleofremotesensinginecologicalresearch.</p>	14
References	<p><b>TextBooks</b></p> <ol style="list-style-type: none"> <li>1. Smith DM, Larson BC, Ketty MJ and Ashton PMS. 1997. ThePractices of Silviculture- Applied Forest Ecology. John Wiley &amp; Sons.</li> <li>2. Baldwin, H.I. 1942. Forest Tree Seed of the North TemperateRegions.Periodical Experts Book Agency,Delhi.</li> <li>3. Khullar, P. et. al. 1992. Forest seed. ICFRE, New Forest, DehraDun.</li> </ol>	

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	<p>4. Schmidt, L. 2000. Guide to handling of tropical and subtropical forest seed. DANIDA Forest Seed Centre, Denmark.</p> <p>5. Willan, R.L. 1985. A guide to forest seed handling. FAO Forestry Paper 20/2, DANIDA Forest Seed Centre, Denmark and FAO, Rome.</p>	
	<p>6. Nair PKR. 1993. An Introduction to Agroforestry. Kluwer Academic Pub.</p> <p>7. Nair PKR, Rai MR and Buck LE. 2004. New Vistas in Agroforestry .</p> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Buck LE, Lassoie, Fernandes ECM 1999. Agroforestry in Sustainable Agri. Systems, CRC Press.</li> <li>2. Shah SA. 1988. Forestry for People. ICAR.</li> <li>3. Tiwari KM. 1988. Social Forestry and Rural Development. International Book Distr.</li> <li>4. Sharma LC. 1980. Forest Economics, Planning and Management. International Book Distributors, Dehra Dun.</li> <li>5. Anonymous 2006. Report of the National Forest Commission. Govt. of India, New Delhi.</li> <li>6. Gupta T., Gularia A. 1992. Non Wood Forest products in India: Economic Potentials. Oxford and IBH publishing Co. New Delhi.</li> <li>7. Mishra T.K, Banerjee, Pal, D.C. 2004. An Omnibus of Non-Timber forest products of India, Prashant Gahlotat Valley. Offset Printers and Publishers, Dehra Dun.</li> <li>8. Nautiyal S and. Kaul A.K. 2003. Non-Timber Forest Products of India. Jyothi Publishers and Distributors, Dehra Dun.</li> <li>9. Tribhawan Mehta. 1981. A handbook of Forest Utilization. Periodical expert book agency</li> <li>10. Tropical forests, Ed. Holm-Neilsen L.B. Nielsen. DC and Balslev II Academic press, London, 1989.</li> <li>11. De Vere Burton L. (2000). Introduction to Forestry Science. Delmar Publishers, New York.</li> <li>12. Negi, S.S. (1994). India's Forests, Forestry and Wildlife. Indus Publishing Co., New Delhi.</li> <li>13. Agarwal A.P. Forests in India. Oxford &amp; IBH.</li> <li>14. Puri G. S. Indian Forest Ecology, Vol I, II. Oxford, New-Delhi. Champion G. Hand Seth S.K. A revised survey of the forest type of India - An introductory text book. ITC, The Netherlands.</li> <li>15. Quante, M. (Shanmughavel, P. 2014. Forest Botany, Pointer Publishers.</li> </ol>	

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	<p><b>16. Bor,N.L.2008.AManualofIndianForestBotanyInternationalB ook Distributors.</b></p> <p><b>17. SinghM.P.,SinghJ.K.,MohankaN.&amp;SahR.B.2007.ForestEnvi ronmentandBiodiversity.2ndEdition.DayaPublishingHouse.</b></p> <p><b>18. P.D.Sharma(2019).PlantecologyandPhytogeography.Rastogi PublicationsReprint</b></p>	
	<p>19. Bharucha F.R. A text book of plant geography of India. OxfordUniversityPress</p> <p>20. Huisman,O.&amp;deByR.A.(Editors)2009.Principlesofgeographics ystem2010).Relictspecies:PhylogeographyandConservationbiology. DOI:<a href="https://doi.org/10.1007/978-3-540-92160-8">10.1007/978-3-540-92160-8</a></p> <p>21. Bharucha, F. R. 1984. A Text Book of Plant Geography of India.OxfordUniversity Press.</p> <p>22. RonaldGood.1964.TheGeographyofFloweringPlants.Longmans .</p> <p>23. FurleyPAet.al.,(1983).Geographyofthebiosphere:Anintroduction tothe nature, distribution and evolution of the worldlifezones. Butterworths.</p> <p>24.JonesHG,VaughanRA.Remotesensingof vegetation.Oxford universitypress.</p>	
CourseOutcomes	<p>Oncompletionofthecourse, studentsshouldbe ableto</p> <p>CO1:toknowthebasicfactsofForestecologyanditsassociatesCO2:to oacquireknowledgeonForestecosystem andNWFP</p> <p>CO3:to survey and analyse the various phytogeographical regions ofCO4:World</p> <p>CO5:tounderstandtheroleofremotesensing inforest surveyand conservation.</p>	

**Mappingof Coswith PSOs**

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	2	3	3	2
CO3	3	3	3	3	3
CO4	3	2	3	3	3
CO5	2	3	3	3	2

M.Sc.BotanySyllabus(July2021onwards)

Semester	<b>Third</b>	CourseCode	<b>21BOTP0316</b>
CourseTitle	<b>PRACTICALS-IV: BIOINSTRUMENTATION</b>		
No.ofCredits	2	No.ofcontacthoursper week	4
New Course/Revised Course	RevisedCourse	Ifrevised,Percentageofrevisioneffectected(Minimum 20%)	30
Category	Core		
ScopeoftheCourse(may be more thanone)	<ol style="list-style-type: none"> <li>1. Rewardingopportunitytoupdatetherecenttechniquesinbioinstrumentation</li> <li>2. Able to learn the principles, procedures and applications ofchromatography,electrophoresis,UV-Visspectroscopy,FT-IR,SEM, AAS andNMR.</li> <li>3. Enhancethe potential tohandle the bioinstruments</li> </ol>		
Cognitive Levelsaddressed by theCourse	K1- Exposure to the instruments in biological sciences K2- Imbibethetechniquesinvolvedinbioinstrumentation K3- Demonstrateknowledgeandunderstandingonthebasicprincipleofbioinstruments K4- ImplementationofExperimentalprotocols K5- Assessment ofexperimental results		
Course Objectives(Maximum:5)	TheCourseaims <ul style="list-style-type: none"> <li>• toknowthepreparationofbuffersand determinationofpH.</li> <li>• toseparateaminoacidsandsugarsusingchromatographyandelectrophoresis</li> <li>• toseparategas andorganicacids usingGC andHPLC</li> <li>• to estimate proteins, sugars, nucleic acids, chlorophyll, sodium, potassium,calciumand magnesium using different equipments.</li> <li>• to know the protocols involved in the estimation of biological samplesusingSEM, FT-IR, AAS and NMR.</li> </ul>		
Practicals	Content	No.ofHours	
1.	Preparationofbuffers.		
2.	DeterminationofpHinwaterandsoilsamples.		
3.	Separation of amino acids and sugars using paper chromatography(2D)		
4.	Separationofaminoacidsandsugarsusingthinlayer chromatography		
5.	Separationofpigmentsbycolumnchromatography		
6.	Differentialcentrifugationofsamples.		
7.	SeparationofgasandorganicacidsusingGCandHPLC (Demonstration).		
8.	Separationofproteinsusingverticalgelelectrophoresis.		
9.	EstimationofProteinusingSpectrophotometer		
10.	Estimationofsodium,potassium,calciumandmagnesium usingFlamephotometer		
11.	Estimationof calorificvalue offeed/ firewood samples.		

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DemonstrationofBiologicalsamplesusingSEM,FT-IR,  
AAS,NMR.

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References	<p>1.Rodney Boyer, 2001.Modern Experimental Biochemistry. III Ed.AddisonWesleyLongmanPte.Ltd,IndianBranch,Delhi,India.</p> <p>2. J.Jeyaraman1981. LaboratoryManualinBiochemistry. NewAgeInternationalpublishers,New Delhi.</p>
CourseOutcomes	<p>Oncompletionofthecourse, studentsshouldbe ableto</p> <p>CO1:Preparebuffersof desiredpH</p> <p>CO2:Separateaminoacidsandsugarsusingpaperandthinlayerchromatography</p> <p>CO3: Estimate proteins,sodium,potassium,calcium and magnesium usingspectrophotometerand flame photometer.</p> <p>CO4:Separateproteinsusingverticalgelelectrophoresis</p> <p>CO5:Knowthebiologicalapplicationsof SEM,FT-IR,AASandNMR</p>

### MappingofCoswithPSOs

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3

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Semester	<b>FOUR</b>	CourseCode	<b>21BOTP0418</b>
CourseTitle	<b>FUNDAMENTALSOFMICROBIOLOGY</b>		
No.ofcredits	<b>4</b>	No.ofcontacthoursperweek	<b>4</b>
New Course /RevisedCourse	RevisedCourse	If revised,percentage of Revision effected( <b>Minimum 20%</b> )	40%
Category	Corecourse		
ScopeoftheCourse(May be more thanone)	<ul style="list-style-type: none"> <li>❖ Basicunderstandingonthemorphologyandfunctionsofthe structures with theprokaryotes and eukaryotes</li> <li>❖ Skilldevelopmentmicrobiologicalculturaltechniques</li> <li>❖ Createsemployabilityscopeinthemicrobiological laboratories/hospitals/ industries</li> </ul>		
Cognitive Levelsaddressed by thecourse	K-1 Ability to remember historical and recent developments inmicrobiology K-2 Graspthe comprehensiveknowledgeonSystematicbacteriologyK-3Usemicrobiologicaltoolsforbetterunderstandingofmicrobial structuresandtheir functions K-4Capacity to analyze factors influencing microbial growthK-5MakenewtechniquestostudymicrobialactivityinnatureK-6Assessmentof disease-causing microorganisms		
CourseObjectives	Thecourse aimsto: <ul style="list-style-type: none"> <li>• enhancethe student's knowledge in historical aspects and microscopic techniques</li> <li>• acquirean overall knowledge on the morphology and functions of the structures with the prokaryotes and eukaryotes.</li> <li>• makethe students knowledgeable on classification and diversity of microorganisms</li> <li>• developknowledge in microbial control techniques and various culture techniques used in the microbiological lab</li> <li>• givean overview on the diseases caused by various microorganisms</li> </ul>		

UNIT	Content	No. of Hours	
I	<b>History and classification of Microorganisms</b> Historical and recent developments - Scope of microbiology - Spontaneous generation and germ theory of disease - Major contribution of scientists - Leeuwenhoek, Edward Jenner, and Alexander Fleming, Joseph Lister, Robert Koch and Louis Pasteur. Modern Microbiology - Landmark achievements in 20th century. Microscopy: Simple, Compound, Darkfield, Phase contrast, Fluorescence and Electron microscopy.		13



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I	<p><b>TaxonomyandDiversityofMicroorganisms</b>            Generalprinciplesofclassificationofmicroorganisms–            MajorCharacteristics Used in Taxonomy – Haeckel’s three kingdom concept –Whittaker’sfivekingdomconcept–            threedomainconceptofCarlWoese.BriefviewonbacterialclassificationaccordingtoBergey’smanual of Systematic bacteriology. Classification and salient features ofalgae, fungi, protozoa and viruses. Overview on the microbial culturecollections.</p>	
III	<p><b>ProkaryoticandEukaryoticCell(SourceNPTELcourse)</b>            Ultra structure of Prokaryotic and Eukaryotic cell- The Prokaryotic Cell:Size, shape and arrangement of bacterial cells; structure of cell wall, andstructures external (glycocalyx, flagella, pili, etc.,) and internal (plasmamembrane,cytoplasm,inclusionbodies,etc.,)tothecellwall.TheEukaryoticCell:Cilia,flagella,cytoskeleton,cytoplasmembranesystems, mitochondria and chloroplast Comparison of Prokaryotic and Eukaryoticcell.</p>	13
IV	<p><b>MicrobiologicalTechniques</b>            Microbial control – Physical methods - Chemical methods – Evaluationandmonitoringofsterilizationprocedures- Usedilutiontests,Disc-Diffusion method – Decimal reduction time (D Value). Pure culturetechniques,typesofmedia-mediapreparation-preservationofcultures -aerobic andanaerobicculture techniques.Growthof bacteria:batchand synchronous culture - factors influencing growth. Growth curve-Microbial nutrient -macro nutrients, micronutrients, growth factors andsourcesofnutrients-Methodstostudymicrobialmorphology-wetmountandhangingdropmethod.Stainingtechniques-Gram's,acid fast,sporeandcapsulestaining</p>	13
V	<p><b>MicrobiologyofDiseases111`</b>            Infections: types of infection, sources of infection, reservoirs and vectorsof infection. Normal microflora of the human body. Classification ofmedicallyimportantmicroorganisms;Bacterialdiseases:Staphylococcus, Streptococcus,Neisseria;Corynebacterium,Clostridium,Vibrio,Yersinia, Haemophilus,Mycobacterium.Fungaldiseasesofman,Epidemiology.Dermatophytes,dimorphicfungi,opportunisticfungalpathogens.Viraldiseases: Poxviruses;Herpesvirus,Hepatitisviruses,coronavirusesandHumanImmunodeficiency viruses(HIV)</p>	12
References	<p><b>TextBooks:</b></p> <ol style="list-style-type: none"> <li>1. Jeffery C. Pommerville (2016). Alcamo's Fundamentals of Microbiology(ThirdEdition).JonesandBartlettLearning.LLC,Burlington,MA01803.</li> <li>2. Tortora,G.J,FunkeB.R.andCase,C.L..2010.Microbiology:Anintroduction10<sup>th</sup>Ed, Benjamin Cummings, N.Y.</li> <li>3. Wiley,J.M.,Sherwood,L.M.andWodverton,C.J.2009.Prescott’sprincipleof Microbiology, McGrawHill, New York.</li> </ol>	

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	<p>4. Dubey, R. C. and Maheswari, D. K. 2005. A text book of Microbiology, Revised Edt., S. Chand Publishers, New Delhi.</p> <p>Pelczar, Jr., Michael, Chan E. C. S. and Kreig Noel. 2000. Microbiology. 5<sup>th</sup> Ed. Tata McGraw Hill Book Company.</p> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Stanier, Y. Roger, John L. Ingrahm, Mark L. Wheelis and Page R. Painter. 2003. General Microbiology. V Ed. MacMillan Press Ltd. New Jersey. pp: 621-626; 655-670.</li> <li>2. Sundararajan, S. 2003. Microorganisms. I Ed. Anmol Publications Pvt. Ltd. New Delhi.</li> <li>3. Hans G. Schlegel. 2012 (Reprint). General Microbiology. VII Ed. Cambridge University Press. UK.</li> <li>4. Salle, A. J. 2001. Fundamental and Principles of Bacteriology. 7<sup>th</sup> Ed. Tata McGraw Hill Publishing Co. Ltd.</li> <li>5. John L. Ingrahm and Catherine Ingrahm. 2000. Introduction to Microbiology. II Ed. Brooks/Cole, Thompson Learning division. USA.</li> <li>6. Lansing M. Prescott, John P. Harley and Donald A. Klein. 2002. Microbiology. V Ed. WCB/McGraw Hill Company.</li> <li>7. Brock, T. D., Smith, D. W. and Madigan, M. T. 1997. Biology of Microorganisms: Milestones in Microbiology. Prentice-Hall International Inc. London.</li> <li>8. Talaro, K. and Talaro, A. 1996. Foundations in Microbiology, 2<sup>nd</sup> Ed., Wm. C. Brown publishers, Toronto.</li> <li>9. Heritage, J. Evans E. G. V. and Killington, R. A. (1996). Introductory Microbiology. Cambridge University Press.</li> </ol> <p><b>Web resources:</b></p> <p><a href="https://www.cliffsnotes.com/biology/microbiology">https://www.cliffsnotes.com/biology/microbiology</a></p> <p><a href="https://www.livescience.com">https://www.livescience.com</a></p> <p><a href="https://www.nature.com/.../microbiology-techniques">https://www.nature.com/.../microbiology-techniques</a></p>
Course Outcomes	<p>On completion of the course, students should be able to:</p> <p>CO 1: Discuss important milestones and accomplishments to appreciate the history</p> <p>CO 2: Identify key organelles and their functions in both eukaryotes and prokaryotes</p> <p>CO 3: Describe the overall classification and diversity of microorganisms.</p> <p>CO 4: Demonstrate microbial control measures and various culture techniques in the laboratory</p> <p>CO 5: Explain the diseases caused by various microorganisms</p>

CO	PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		3	2	1	1	1
CO2		3	2	1	1	1
CO3		3	2	2	1	2
CO4		3	2	2	1	2
CO5		3	3	3	3	3

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Semester	FOUR	CourseCode	21BOTP0419
CourseTitle	PLANTBIOTECHNOLOGY ANDGENETIC ENGINEERING		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ RevisedCourse	NewCourse	If revised, Percentage ofrevision effected (Minimum20%)	20
Category	Core		
Scope of theCourse (maybemorethanone)	1. Comprehendtheknowledgeon plantbiotechnologyandgeneticengineering 2. Realizetherole ofplantbiotechnologyandgeneticengineering inScience 3. Motivatethestudentstounderstandtheimportanceofplantbiotechnologyandgeneticengineeringbecome Plant Scientists		
CognitiveLevelsaddressedbythe Course	K1- Motivate to understand the basic and advancement of plant tissue culture K2- RealizethevariousaspectsofImmobilizationandCell&Suspensionculture K3- Understand the role of Biotransformation and Biosensors and Plant GeneticEngineering K4-Gaintheknowledge fromthispapertoappear nationallevelcompetitiveexams K5-Utilizethe knowledgeacquired throughthis paper invarious botanicalresearches		
CourseObjectives(Maximum :5)	<p><b>TheCourseaims</b></p> <ul style="list-style-type: none"> <li>• to impart knowledgeon the concepts&amp; scopein biotechnology</li> <li>• to providean in-depthstudy onbiotransformationtechniques andbiosensors</li> <li>• to enhanceinterestin Genecloningstrategy</li> <li>• to understandgenetic engineeringconcepts&amp;techniques.</li> <li>• to know thetransgenicorganismsand to acquireknowledgeon GMOs.</li> </ul>		
Unit	Content	No. ofHours	
I	<b>PlantTissueCulture</b> Basic techniques in plant tissue culture. Culture media preparation,sterilization,Micropropagation,cellsuspensionculture,Somaticembryogenesis,protoplastculture.Somatic hybridization..Protoplastisolation, fusionandculturemethods,hybridselectionand regeneration, cybrids, spheroplasts; possibilities, achievementsand limitations of protoplast research. Production of haploid andtriploidplants.Antherandpollencultureandproductionofgametoclones.Embryorescueinhybridplants.Applicationofplant tissuecultureinagriculture,Horticultureandforestry.	14	
II	<b>Immobilizationand Cell&amp;Suspensionculture</b> Culture vessels and bioreactors, culture initiation, growth curve, cellaggregatesandsecondarycompoundsynthesis,useofprecursorsandelicitors,cellimmobilization,biotransformations.Immobilization	14	
III	<b>Biotransformation and Biosensors (Source NPTEL course)</b> Biotransformationandproductionofusefulcompounds– Glycerol,butanol, acetone, alkene oxide, Poly hydroxy butyrate and	11	

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	valerate(PHBV),XanthangumandMicrobialLeaching.Biosensors – definition and outline design- types of electrode systems – Oxygenelectrodesystem,Fuelcelltypeelectrode,Potentiostatic,Piezoelctric membrane and Dye-coupled electrode membrane filtersystems –Biosensors for nutrients (glucose sensors).Sensor for cellpopulation (Lactate sensor) - Biosensor for products (alcohol sensor,formicacidsensorandmethanesensor)- Biosensorforenvironmental control (BOD sensor, Ammonia sensor, Nitrite sensorandSulfite Ion sensor).	
IV	<b>PlantGeneticEngineering(SourceNPTELcourse)</b> Componentsofplantgeneticengineering.RecombinantDNAtechnolog y - molecular tools – nomenclature and characteristics ofRestriction enzymes, ligases and DNA modifying enzymes. Vectorsusedinmolecularcloning:Plasmids– propertiesandclassification– PBR pUC 18. lambda (gt 10) and M13 phage vector. Cosmids (pJB8),Yeast vectors	11
V	<b>Gene cloning strategy&amp; Applications of Genetic engineering</b> Genecloningstrategy– IsolationofforeignDNAandrecombinantDNAconstruct– Transformation–Screeningandselection.Expressionofclonedgenes– Briefaccountonmethodsforanalysisofdifferentialgeneexpressioninpla nts.  AgrobacteriumandTiPl asmidbasedandphysicalDNAdeliverymethods.Analysisoftransgenicp lants. Approachestomarker-free transgenics.  Rulesandregulationinbi otechnology– biosafety,bioethics,hazardsofenvironmentalengineering.Developmen toftransgeniccropsfordiseaseresistance,insectresistance(Bttoxinand useofproteaseinhibitors),herbicidetolerance,salttolerances,droughttol erance, andnutritionalquality–BriefoutlineonBtCotton&goldenrice.	14
References	<b>TextBooks</b> 1. Dubey R.C., 2014.Advanced Biotechnology 1 <sup>st</sup> Edition.S.Chand&CompanyLtd.,New Delhi. 2. S.B.Primrose,R.M.Twyman,andR.W.Old(2012).PrinciplesofGen eManipulations;6th Edn. Blackwell Science. 3. ChhatovalG.R.,1995.TextbookofBiotechnology,1 <sup>st</sup> Ed,AnmolPub lications Pvt.Ltd., New Delhi. 4. Kumar H.D., 1991. A textbook on Biotechnology2 <sup>nd</sup> Ed, East- westPressPrivateLtd.,NewDelhi.Pg.1-250;411-472;534-555. 5. Glick,B.R.andPasternak,J.J1994.MolecularBiotechnology,ASMP ress, WashingtonDC. <b>ReferenceBooks</b> 1. DubeyR.C.,2001.AtextbookofBiotechnology1 <sup>st</sup> Edition.S.Chand &CompanyLtd.,New Delhi. 2. Glick,B.R.andPasternak,J.J1994.MolecularBiotechnology,ASMP	

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	<p>ress, WashingtonDC.</p> <p>3. Kumar,H.D.1993.Molecular Biology &amp;Biotechnology,VikasPublishing HousePvt., Ltd., New Delhi.</p> <p>4. Kumar,H.D.1991Biotechnology,2ndEd.,East–WestPress PrivateLtd.,NewDelhi.</p>	
	<p>5. Trevan, M.D, Boffey, S., Goulding, K.H. and Stanbury, P. 1990.Biotechnology- The basic Principles. Tata McGraw Hill,NewDelhi.</p> <p>6. Demain,A.L.,Solomon,N.A.1986.”ManualofIndustrialMicrobiologyandBiotechnology”,ASMPress,Washington.</p> <p>7. RobertF.Weaver,2012MolecularBiology;McGrawHill</p> <p>8. KeithWilsonandJohnWalker2010PrinciplesandTechniquesofBiochemistry and MolecularBiology; 7th Edn.</p> <p>9. T.A.Brown2006GeneCloningandDNAanalysis- AnIntroduction,;5thEdition, WileyBlackwell Publishing</p> <p><b>Web resources</b>  1.https://www.edx.org/learn/biotechnology  2.https://biog.feedspot.com/genetics-blogs/3.learn.genetics.utah.edu/  4.http://bmcbiotechnol.biomedcentral.com</p>	
CourseOutcomes	<p>Uponcompletionofthiscourse,studentsbeableto:</p> <p>CO1: to impart knowledge on the concepts &amp; scope in biotechnology</p> <p>CO2: to provide an in-depth study on biotransformation techniques and biosensors</p> <p>CO3: to enhance interest in Gene cloning strategy</p> <p>CO4: to understand genetic engineering concepts &amp; techniques.</p> <p>CO5: to know the transgenic organisms and to acquire knowledge on GMOs.</p>	

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3

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Semester	Four	CourseCode	<b>21BOTP0420</b>
CourseTitle	<b>APPLIEDMYCOLOGY ANDPLANT PATHOLOGY</b>		
No.ofCredits	4	No.ofcontacthoursper week	4
NewCourse/ Revised Course	NewCourse	If revised, Percentage ofrevisioneffected(Minimu m 20%)	20
Category	Core		
Scope of theCourse (maybemoret hanone)	1. Understandvariousaspects of Mycologyand plant pathology 2.UtilizethetheknowledgeofMycologyandplantpathologyonotherbotanicalresearche s 3. ComprehendtheknowledgeonMycologyandplantpathologyforvariouscompetit iveexaminations.		
CognitiveLe velsaddresse dbythe Course	K1- Inculcate the advancement ofMycology and plant pathologyK2- AcquirethetheknowledgeonimportanceofMycologyinIndustriesK3- Understandtherole of MycorrhizainagricultureandForestry K4-Surveyandevaluation andunderstanding thevariousplantpathogens K5-Create awareness onmanagementofplantdiseases		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> • Toevaluatethediversity ofvariousfungalspecies • Toanalyseroleoffungi as foodand beverage • ToevaluatetheimportanceofMycorrhizal technologyinagriculture • Tounderstandthevarious plantpathogensandits mechanismofinfection • Tocreatetheawarenessonmanagementofvariousplantdiseases		
Unit	Content	No.of Hours	
I	<b>Fungaldiversity</b> Fungaldiversityindifferentecosystems:FungalDiversity:Anamorphicf ungi-i)Nematophagousfungiii)Aquaticchyphomycetousfungiiii)Aero- aquaticfungi.Thestructureandcomposition of fungal cell, effect of environment on fungal growthand behavior.Enzyme technology: Fungal enzymes of commercialimportance, production of fungal enzymes, free and immobilizedcellsandenzymes.Fungalttoxins:Mycotoxicoses- fungiindermatomycosis,aspergillosisandfungiallergenictomanand animal.	12	
II	<b>Fungiasfoodandbeverage</b> Alcoholicbeverage,mushroomsandothermacrofungi,ediblebiomass from yeast and moulds, single cell proteins (SCP). Fungi infood processing: Bread,soybean products,cheese andfermentedmilk, other fermented foods. Fungal metabolites: Primary metabolitesofeconomicimportance,secondarymetabolitesin	15	

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	medicineandagriculture.Biodeteriorationandbiodegradationby fungi:Textiles,leather,plastic,hydrocarbons,metalsandpesticides.	
III	<p><b>Mycorrhizaltechnology</b></p> <p>Mycorrhizaltechnology:Ectophyticandendophyticmycorrhiza,mycorrhizainplantgrowthpromotion,mycorrhizalinteractionswithsoilmicroorganisms,mycorrhizainplantdiseasecontrol.Future of fungal biotechnology: Production of mammalian proteinsbyfungi,otherapplicationsofgenecloninginfungiandtheir importance.CultivationtechnologyofMycorrhiza andapplication</p>	10
IV	<p><b>Plantpathology</b></p> <p>Historical and developmental aspects of plant pathology. Mode ofinfection and role of enzymes and toxins in plant disease. Defense mechanisms of plants against infection: Preexisting structural andchemicaldefense,inducedstructuralandchemicaldefense,hypersensitivereaction,roleofphytoalexinsandotherphenoliccompounds. Brief account on downy mildew of cucurbits, stem gallof coriander, peach leaf curl, Tikka disease of groundnut, bacterialblightofrice,leafcurloftomato,potatospindletubermosaic,ear cocklesofwheat,phylloidyofsesamum,Citrusgreening</p>	12
V	<p><b>Managementofplantdiseases</b></p> <p>Managementofplantdiseases:Cultural,chemical,biological,biopesticides,breedingforresistantvarieties,plantquarantine,integrated pest management. Fungi in plant disease control: Currentlimitstobiologicalcontroloffungalphytopathogens,moleculara pproachincontroloffungalpathogens,biotrophicmycoparasitism, strainsselectionandtheir improvementforbiocontrol.</p>	14
References	<p><b>TextBooks</b></p> <ol style="list-style-type: none"> <li>1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M.,1996.<i>Introductory mycology</i>(No. Ed.4). JohnWiley andSons.</li> <li>2. Deacon, J.W., 1997. <i>Modern mycology</i>(Vol. 3). Oxford:BlackwellScience.</li> <li>3. Rai,M.andBridge,P.D. eds.,2009. <i>Appliedmycology</i>.CABI.</li> <li>4. Galloway, L.D., 1939. <i>Applied mycology and bacteriology</i> (Vol.48,No. 4, p. 356). LWW.</li> <li>5. Arora, D.K., 1991. <i>Handbook of Applied Mycology: Volume 1:Soiland Plants</i>. CRC Press.</li> <li>6. Satyanarayana,T.,Deshmukh,S.K.andJohri,B.N.eds.,2017. <i>Developmentsin fungal biology and appliedmycology</i>(pp.525-541).Singapore::Springer.</li> <li>7. Mahendra,M.,Dennis,P.andDennis,P.,Applied Mycology.</li> <li>8. Ajello,L. and Mukerji, K., 1993. Handbook of applied</li> </ol>	

M.Sc.BotanySyllabus(July2021onwards)

	<p>mycology.  <i>RevistadoInstitutoMedicinaTropicaldeSãoPaulo</i>,35, pp.314-314.</p> <p>9. Agrios,G.N.1999.PlantPathology.AcademicPress</p> <p>10. Chandanwala, K. 1986. Introduction to Plant Pathology. AmmolPublishersand Distributors.</p> <p>11. Horsfall, J.G. &amp;Cowelling. 1978. Plant Diseases – An AdvanceTreatiseVol.II&amp;IVAcad Press.</p> <p>12. Mehrotra,R.S.1991.PlantPathology.TataMcGraw–HillPublishingCompany Ltd.</p> <p>13. Roberts, S. Fritz &amp; Elien. I. Simms. 1992. Plant Resistance toHerbivorsandPathogens(Ecology,EvolutinandGenetics),Univercityof Chicago Press.</p> <p>14. Rudra P. Singh, Uma S. Singh &amp;KeiisukeKohmoto (eds.) 1995.Pathogenesisandhostspecificityinplantdiseases.Vol.IIIPerгамonPress.</p> <p>15. Scheffer, R.P. 199. The nature of disease in plants. CambridgeUniversityPress.</p> <p>16. Tarr,S.A.J.1987.PrinciplesofPlantPathology.AcademicPress 20.</p> <p>Verma, A &amp; Hock, B. 1999. Mycorrhizae. SpringerPublishers.</p> <p>17. AlexopoulosC.J.,Mims,C.W.&amp;Blackwell,M.1996.IntroductoryMycology. 4<sup>th</sup>edition. JohnWiley&amp;Sons Inc.</p> <p>18. Ainsworth, G.C., Sparrow, K.F.&amp;Susmann, A.S.(Eds.) 1973.TheFungi-AnAdvanced Treatise. Vol1-4. AcademicPress.</p> <p>19. Burnett,J.H.1970.FundamentalsofMycology.EdwardAmolds.</p> <p>20. Dubey, H.C. 1990. AnIntroduction to Fungi. 2<sup>nd</sup>Edition. VikasPublishers,New Delhi.</p> <p>21. Jennings,D.H.&amp;Lysek,G.1999.FungalBiology.BiosScientificPublishers.</p> <p>22. Mehrotra,R.S.&amp;Aneja,K.R.1990.AnIntroductiontoMycology.New AgeInternational Publishers.</p> <p>23. Landecker, Elizabeth Moore. 1996. Fundamentals of Fungi. 4<sup>th</sup>Ed.PrenticeHall.</p> <p>24. Webster,John1980.IntroductiontoFungi.CambridgeUniversity Press. 12. Agrios, G. N. 1997. Plant pathology. 4<sup>th</sup>Ed.,AcademicPress.</p> <p>25. Bilgrami, K.H. &amp;Dube, H C. A Text Book of Modern PlantPathology.Vikas Publishers, NewDelhi.</p> <p>26. Mehrotra,R.S.1980.PlantPathology.TataMcGrawHill.</p> <p>27. Pandey,B.P.1999.PlantPathology-pathogenandplant</p>	
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## M.Sc.BotanySyllabus(July2021onwards)

	disease.S.Chand&Co.	
CourseOutcomes	<p>On completion of the course, students should be able to</p> <p>CO1: gain the knowledge on diversity of various fungal species</p> <p>CO2: understand the role of Fungus in food and beverage</p> <p>CO3: evaluate the importance of Mycorrhizal technology in agriculture</p> <p>CO4: analyse the details of various processes of IPR in Life Sciences</p> <p>CO5: create the awareness on management of various plant diseases</p>	

### Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	2	3	2	2
CO3	3	2	2	2	2
CO4	3	2	3	3	3
CO5	3	3	3	2	2

**M.Sc.Botany Syllabus(July 2021 onwards)**

Semester	<b>First</b>	Course Code	<b>21BOTP0421</b>
Course Title	<b>PRACTICALS-5:FUNDAMENTALS OF MICROBIOLOGY AND PLANT BIOTECHNOLOGY</b>		
No. of Credits	2	No. of contact hours per Week	3
New Course/Revised Course	Revised Course	If revised, Percentage of Revision effected (Minimum 20%)	20%
Category	Core Course		
Scope of the Course (maybe more than one)	Demonstrate practical skills in the use of tools and methods common to microbiology Hands on training in sampling of microorganisms from various environments		
Cognitive Levels addressed by the Course	K-1:(Remember)K-2:(Understand)K-3:(Apply) K-4:(Analyze)K-5:(Evaluate)		
Course Objectives (Maximum:5)	The Course aims to enhance the student's knowledge and impress upon them on the important aspects of microorganisms provide practical knowledge and skills in the isolation and handling of microorganisms to understand the working procedure and principles of microscopes. know pure culture techniques, methods of culturing preservation and maintenance of microorganisms gain skill in isolation of microorganisms from various samples.		
UNIT	Content	No. of Hours	
1	a) Safety measures and rules of conduct to be followed in a microbiological laboratory. b) Cleaning of Glassware c) Handling and Care of Microbiological Instruments	3	
2	a) Microscopic Examination of Living Organisms – Demonstration of Motility (Hanging drop method). b) Measurement of Microorganisms using Micrometry.	3	
3	Staining Techniques – Gram's staining, capsular staining, endospore staining and acid fast staining	3	
4	Preparation of Culture Media for Microorganisms. Preparation and sterilization.	3	
5	Demonstration techniques for pure culture of microorganisms-serial dilution technique, pour plate, spread plate and streak plate technique.	3	
6	Methods of culture preservation and maintenance-maintenance by sub culturing	3	
7	Enumeration and isolation of Bacteria, Fungi and actinomycetes from soil using serial dilution and plating technique.	3	
8	Enumeration of microorganisms from Air using Air sampler	3	

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9	Quality analysis of milk-Methylene blue reductase and standard plate count method	3
10	Standard Qualitative Analysis of Water by MPN test	3+3
11	Isolation of anaerobic bacteria	3
12	Isolation of DNA from Plant samples	3
13	Demonstration of Plant Tissue culture techniques	3
14	Production of Synthetic seeds	3
References	<p>Text Books</p> <p>James. G. Cappucino. And Natabe Sherman, 2004. Microbiology – A Laboratory Manual, VI Ed., (Indian Reprint). Pearson Education (Singapore) Pvt. Ltd., India.</p> <p>Dubey, R.C and Maheswari, D.K. 2002. Practical Microbiology, I Ed., Chand and Company Ltd., India.</p> <p>Aneja. K.R, 2002. Experiments in Microbiology plant pathology tissue culture and mushroom production technology, III Ed. New Age International publishers (P) Ltd, New Delhi.</p> <p>Breed and Buchanan. Bergey's Manual of Systematic Bacteriology. 2nd Edition, (Volumes. 1 – 5) (2001–2003).</p> <p>P.P Alanivel. Analytical Biochemistry and Separation Techniques. Twenty-first century Publications, Madurai</p>	
	<p>Reference Books:</p> <p>Goldman, E. and Green, L.H. eds., 2015. Practical handbook of microbiology. CRC press. O'Leary, W.M., 1989. Practical handbook of microbiology. CRC press.</p>	
	<p>E-Resources (URLs of e-books/YouTube videos/online learning resources, etc.)</p> <p><a href="https://microbiologysociety.org/publication/education-outreach-resources/practical-microbiology-for-secondary-schools.html">https://microbiologysociety.org/publication/education-outreach-resources/practical-microbiology-for-secondary-schools.html</a></p> <p><a href="https://www.micropia.nl/en/discover/stories/experiments/">https://www.micropia.nl/en/discover/stories/experiments/</a></p>	
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>CO1: Demonstrate standard methods for the isolation, identification and culturing of microorganisms.</p> <p>CO2: Explain the ubiquitous nature of microorganisms</p> <p>CO3: Identify the different groups of microorganisms from different habitats. CO4: Evaluate the microbial load in soil and food samples</p> <p>CO5: Examine the microbial quality of air and water</p>	

**21GTPP00H1-HUMANVALUES ANDPROFESSIONAL ETHICS**

**(TwoCredits)**

**MODULARCOURSEFORP.G.PROGRAMMES**

**Credits:2**

**CFA:20+25+5**

**Total:50**

**Objectives:**

- ▶ Toenablestudentstoacquirebasicknowledgeandexposuretohumanvaluesandprofessionalethics.
- ▶ tomotivatethestudentstoimbibeandpracticevaluesandethicsintheirprofessionandsocialinteractions.

**LearningOutcome**

Studentswill beable to

- ▶ Comprehendthesignificance
- ▶ andimportanceofvaluesandtheirpervasivenessGainknowledgeon thedifferentaspects ofvaluesand ethics
- ▶ Haveexposureon thepractical dimensionsof professionalethics

**Unit 1 Concept of Human values:** need for values and ethics in human life, types of values:**Personal and moral values:** love, truth, tolerance, wisdom, sacrifice, sincerity, self-control, altruism and scientific vision - **Social values:** equality, humaneness, universalbrotherhood,empathy,probity.

**Unit2PoliticalandConstitutionalvalues:**democracy,socialism,secularism,equality,justice,liberty, freedomandfraternity-**Religiousvalues:**faith,love,compassion,forgiveness, tolerance,equalrespectforallreligions,selflessness,awareness,nonattachment, characterandvirtues.

**Unit 3 Aesthetic values:** appreciation of literature and fine arts and nature - **Economic values:**fairness, honesty, business integrity, eco-centric - **Environmental values:** respect andconcern for nature and its fauna and flora - **Professional values:** quest for knowledge,competency,sincerity in profession, regularity, punctuality.

**Unit 4 Ethics:** Meaning, domains of ethics, need for ethics, challenges to ethics, ethics andmorality,role ofethics inwork environment.

**Unit 5 Professional Ethics:** pride in their work, trust with confidences, honesty, trustworthy,moral,corruptionfreeandloyal,personalcommitmenttoquality,sharingtheburden-

takeresponsibility,**EthicalIntelligence:**Donoharm,makethingsbetter,respectothers,befair(no bias / prejudice), beloved.

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### ReferenceBooks:

- Dr.ShivaandDr.BalajiLoganathan,2011, 'ValueEducation', SreeGomathiPublications, Chennai.
- BabuMuthujaandR.Usharani,2009, 'PeaceandValueEducation', CentrumPress, NewDelhi,.
- S.Srinivasan,2005, 'ValueBasedManagement', JaicoBooks, Mumbai,.
- HerveMorisette,2001, 'PathstoNewValueEducation', IndianCatehetical Association, Bangalore.
- R.S.Naagarazan,2006, 'A TextbookonProfessionalEthicsandHumanValues', NewAgeInternationalPublishers, New Delhi.
- PushpamKumarandB.SudhakaraReddy,2007, 'EcologyandHumanWellBeing', SagePublications, New Delhi.
- Dr.KirubaCharlesandV.ArulSelvi,2016, 'ValueEducation', Neelkamal; Firstedition, NewDelhi.
- A.R.Mohapatra andBijayaMohapatra,2014, 'ValueEducation: AStudyinHumanValuesandVirtues', ReadworthyPublications, New Delhi.
- GaurR.R, SangalR,2010, 'A FoundationCourseinHumanValuesandProfessionalEthics', ExcelBooks, New Delhi.
- JustinOakley, DeanCocking,2001, 'VirtueEthicsandProfessionalRoles', CambridgeUniversityPress, UnitedKingdom.
- GogateS.B,2010, 'HumanValuesandProfessionalEthics', HumanValuesandProfessionalEthics, Vikas PublishingHouse; First edition, New Delhi.
- GregoryRMaio,2016, 'ThePsychologyofHumanValues', RoutledgePublications, NewYork.
- JohnClammer,2018, 'CulturalRightsandJustice: SustainableDevelopment, theArtsandtheBody', PalgraveMacmillan, 1st ed. 2019 edition, U.K.

### Weblinks:

- Thich Nhat Hanh, 2008, Good Citizens: Creating Enlightened Society:[http://archive.kdd.org/good\\_citizens\\_creating\\_enlightened\\_society\\_thich\\_nhat\\_hanh.pdf](http://archive.kdd.org/good_citizens_creating_enlightened_society_thich_nhat_hanh.pdf).
- Thought of Human Value education According to Mahatma Gandhimangement.nrjp.co.in/index.php/JSSMMS/article/download/155/294.

## M.Sc. Botany Syllabus (July 2021 onwards)

### Discipline-centric Courses

Semester	Fourth	Course Code	21BOT P03D1
Course Title	<b>TRENDS IN MODERN BOTANY</b>		
No. of Credits	3	No. of contact hours per week	3
New Course/ Revised Course	New Course	If revised, Percentage of revision effected (Minimum 20%)	-
Category	<b>Discipline-centric</b>		
Scope of the Course (may be more than one)	1. Understand the various advancement of plant sciences 2. Acquire the knowledge on Plantontology, taxonomy, molecular biology and genetic engineering 3. Improve the knowledge on various aspects of botany to become plant researchers		
Cognitive Levels addressed by the Course	K1- Analyse the importance of various aspects of modern Botany K2- Examine aspects of Plantontology, taxonomy, molecular biology and genetic engineering K3- Improve the knowledge on modern Botanical sciences K4- Motivate the students to enhance knowledge on Plantontology, molecular biology and genetic engineering K5- Update the skills on botanical sciences to appear competitive examinations		
Course Objectives (Maximum :5)	<b>The Course aims</b> <ul style="list-style-type: none"> <li>• To have comprehensive knowledge on modern aspects of Plant anatomy and Photosynthesis</li> <li>• To understand the mechanism of secondary metabolites production</li> <li>• To understand the various aspects of gene transfer methods</li> <li>• To understand the mechanism of genetic recombination</li> </ul>		
Unit	Content	No. of Hours	
I	<b>Plantontology photosynthesis:</b> Bridging Plant Anatomy and Genomics in the Digital Era, tools, ontology brochure and applications. Advances in photosynthesis and respiration. Photosystems, Photophysics of light absorption, excitation energy transfer; C4 photosynthesis and regulations; and from X-ray crystallography of proteins to the morphology of organelles and intact organisms. Genetic engineering of photosynthesis and artificial photosynthesis	12	

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II	<p><b>PlantTissueCulture:</b>          Applicationsofplantcell,tissueandorganculture,Mediatypes, preparation; callus formation, organogenesis. Somaticembryogenesis,somaclonalvariation,embryo culture,artificial</p>	12
	<p>seeds .Production of secondary metabolites from plant cell cultures - Processes for enhancing the production of secondary metabolites- Technologyofplantcellcultureforproductionofchemicals. methodsandprotocol</p>	
III	<p><b>PlantGenomics</b>          IntroductiontoGenomics,Transcriptomics,Proteomics,Metabolomics andsinglecellgenomics.Genomesequencing,Whole genome shotgun sequencing, Physical mapping of genomes,Clone-by-clonesequencing,Newgenerationsequencingtechnologies, Bioinformatics tools to analyse genomes, Examples ofsequencedgenomes (yeast,<i>Arabidopsis</i> and rice)</p>	10
IV	<p><b>Proteomics</b>          Protein isolation and identification methods SDS -PAGE, Isoelectricfocussing,2Dgelectrophoresis,Peptidesequencing,MassS pectrometrymethodsusedinproteomics,Peptidedatabases,Immunologi cal methods to study protein functions, Protein-proteinand Protein-DNA interactions, Comparative proteomics, subcellularproteomics, quantitative proteomics</p>	14
V	<p><b>ApplicationofPlantbiotechnology</b>          Application of Plant biotechnology for the production of quality oil,Industrial enzymes, paper, biodegradable plastics, antigens (ediblevaccine) and antibodies.Production of crops resistance to abioticand biotic stresses, crop quality improvement, nutrient enhancement,nitrogen fixation, nutrition up-take, production of male sterile lines,plantibodies,vaccines,plantsecondaryproducts,biofuel,bioplasti cs andplantsasbioreactors</p>	13
References	<ol style="list-style-type: none"> <li>1. Torr,J.D.2006.GeneticEngineering- CurrentControversies.GreenhavenPress.</li> <li>2. Magnien, E. &amp; De Nettancourt, D. 1985. Genetic Engineering ofPlantsandMicro- OrganismsImportantforAgriculture.SpringerVerlag.</li> <li>3. GeraldKarp2013.CellandMolecularBiology:ConceptsandExp eriments.7<sup>th</sup>Edition,Wiley, NJ, USA.</li> <li>4. GeoffreyM.Cooper&amp; RobertE.Hausman 2013. TheCell:AMolecular Approach,6th Edition, Sinauer Associates, Inc.,Sunderland,USA.</li> <li>5. Harvey Lodish, Arnold Berk, Chris A. Kaiser &amp; Monty Krieger2012 Molecular Cell Biology. 7<sup>th</sup>Edition, W. H. Freeman, NY,USA.</li> </ol>	

### M.Sc. Botany Syllabus (July 2021 onwards)

	<p>6. Stephen R. Bolsover, Elizabeth A. Shephard, Hugh A. White &amp; Jeremy S. Hyams 2011. Cell Biology: A Short Course Wiley-Blackwell, NJ, USA.</p> <p>7. Doods, J. H. and Roberts, L. W. 1985. Experiments in Plant Tissue Culture, Cambridge University Press.</p>	
	<p>8. George, E. F. 1993-96. Plant propagation by Tissue Culture - 2 vols. Exegetics Ltd.</p> <p><b>Journals and Web-resources:</b></p> <ol style="list-style-type: none"> <li><a href="https://link.springer.com/journal/11240">https://link.springer.com/journal/11240</a></li> <li><a href="https://www.journals.elsevier.com/journal-of-molecular-biology/">https://www.journals.elsevier.com/journal-of-molecular-biology/</a></li> <li><a href="http://www.springer.com/life+sciences/journal/11008">http://www.springer.com/life+sciences/journal/11008</a></li> <li><a href="http://www.sciencedirect.com/science/journal/00222836?sdc=1">http://www.sciencedirect.com/science/journal/00222836?sdc=1</a></li> <li><a href="http://www.scirp.org/journal/ajmb/">http://www.scirp.org/journal/ajmb/</a></li> <li><a href="https://www.nature.com/nsmb/">https://www.nature.com/nsmb/</a></li> <li><a href="https://www.gmb.org.br/">https://www.gmb.org.br/</a></li> </ol>	
	<p>On completion of the course, students should be able to</p> <p>CO1: comprehend the knowledge of modern aspects of Plant anatomy and photosynthesis</p> <p>CO2: understand the mechanism of secondary metabolite production</p> <p>CO3: understand the various aspects of gene transfer methods</p> <p>To understand the mechanism of genetic recombination</p>	

#### Mapping of Cos with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3



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Semester	<b>Fourth</b>	CourseCode	<b>21BOT P03D2</b>
CourseTitle	<b>PHYLOGENYOFANGIOSPERMS</b>		
No.ofCredits	3	No.ofcontacthoursper week	3
NewCourse/ Revised Course	NewCourse	Ifrevised,Percentageof revision effected (Minimum20%)	-
Category	<b>Disciplinecentric</b>		
Scope of theCourse (maybemore thanone)	1. Ableto realizetheadvancement ofplantsystematic 2. Acquiretheknowledgeonplant systematicand itsrolein botanicalresearch 3. Understand the knowledge plant systematic and helps to improve the researchcareerin Botany		
CognitiveLe velsaddresse dbythe Course	K1-Inculcatetheimportanceofplantsystematic K2- Examine the various aspects of advancement of plant systematicsK3-Understand theimportanceofadvancement of plant systematics K4-Acquire the knowledge on basic and advancement of plant systematicsK5-Promote thestudents to become aplant taxonomists		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> • Tohavecomprehensive knowledgeon historyandevolutionof plantsystematics. • Tounderstandtheclassicalandmodernaspectof plantclassification. • TounderstandthevariousaspectsofInternational CodeofNomenclature(ICN). • Tounderstandtheevolutionarytendenciesofdifferntorders		
Unit	Content	No.of Hours	
I	History of developments in taxonomy: Linnaean to post-Linnaeanera; Systematics - concepts and components; Evolutionary ecology-conceptsandprinciples;Microevolution-theoryandconcepts;Species and speciation; Phylogenetic systematics; Macroevolution -inferring phylogenies. Evolutionary tendencies noticed inRanales,Rosales,Centrospermae,Tubiflorae,Amentiferae,Helobiales, Liliflorae,Glumiflorae.	12	
II	Systems of angiosperm classification: Phenetic versus phylogeneticsystem;Cladisticsintaxonomy;relativemeritsanddemerits ofmajorsystemsofclassificationTakhtajan,Cronquist,Thorne.Systems ofAngiospermClassification.Cladisticsintaxonomy, Angiospermphylogenygroup(APG).	15	

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III	Diversity and classification of flowering plants; Biological diversity- concepts and applications; Diversity- patterns, indices and applications. The species concept: Taxonomic hierarchy, species, genus, family and other categories; Principles used in assessing relationship delimitation of taxa and attribution of rank, BSI and its role.	10
IV	International code of Nomenclature (ICN); History of Botanical Nomenclature principles of ICBN; Types method; Author citation; Retention and rejection of names; Publication of names, Phylogeny of Angiosperms: Origin and evolution of angiosperms; Important phylogenetic concepts; Taxonomic evidences obtained from Anatomy, Embryology and Palynology, Chemotaxonomy and Molecular taxonomy.	14
V	Salient features, comparative account on vegetative and sexual characters and field characteristics of Fabaceae, Sapindaceae, Menispermaceae, Rutaceae, Euphorbiaceae, Myrtaceae, Lamiaceae, Rubiaceae, Orchidaceae, Cyperaceae and Poaceae.	13
References	<ol style="list-style-type: none"> <li>1. Simpson, M.G. 2006. Plant Systematics. Academic Press, London</li> <li>2. Sivarajan, V.V. 1996. Principles of plant taxonomy. Oxford and IBHP publishing Co. Pvt. Ltd, New Delhi.</li> <li>3. Sharma, O.P. 2013. Plant Taxonomy. McGraw Hill Education Pvt. Ltd. New Delhi.</li> <li>4. Mondal, A.K. 2005. Advanced Plant Taxonomy. New Central Book Agency (P) Ltd., New Delhi.</li> <li>5. Johri, R.M. 2005. Taxonomy. Vols. I-IV, Sonali Publication, New Delhi.</li> <li>6. Bhattacharyya, B. 2005. Systematic Botany. Narosa Publishing House, New Delhi.</li> <li>7. Subramanyam, N.S. 1999. Modern Plant Taxonomy. Vikas Publishing House, New Delhi.</li> <li>8. Singh, V., Pandey, P.C. and Jain, D.K. 1997. A text book of Botany: Angiosperms. Rastogi Publications, Meerat.</li> <li>9. Singh, V. and Jain, D.K. 1997. Taxonomy of Angiosperms. Rastogi publications. Shivaji Road, Meerat.</li> </ol> <p><b>Journals and Web-resources:</b></p> <ol style="list-style-type: none"> <li>1. <a href="http://www.springer.com/life+sciences/plant+sciences/journal/12225">http://www.springer.com/life+sciences/plant+sciences/journal/12225</a></li> <li>2. <a href="https://biotaxa.org/phytotaxa">https://biotaxa.org/phytotaxa</a></li> <li>3. <a href="http://www.worldcat.org/title/bulletin-of-the-botanical-survey-of-india/oclc/1752752">http://www.worldcat.org/title/bulletin-of-the-botanical-survey-of-india/oclc/1752752</a></li> <li>4. <a href="http://www.iaat.org.in/journal.html">http://www.iaat.org.in/journal.html</a></li> <li>5. <a href="http://www.nordicjbotany.org/">http://www.nordicjbotany.org/</a></li> </ol>	

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	6. <a href="https://www.banglajol.info/index.php/BJPT">https://www.banglajol.info/index.php/BJPT</a>	
	7. <a href="http://www.tandfonline.com/toc/tweb20/current/">http://www.tandfonline.com/toc/tweb20/current/</a>	
	8. <a href="https://www.jstor.org/journal/taxon">https://www.jstor.org/journal/taxon</a>	
	On completion of the course, students should be able to CO1: comprehend the knowledge on history and evolution of plants systematics. CO2: understand the classical and modern aspects of plant classification. CO3: understand the various aspects of International Code of Nomenclature (ICN). CO4: understand the evolutionary tendencies of different orders	

#### **Mapping of Cos with PSOs**

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	3	2	3	3	2
CO3	3	2	3	2	2
CO4	3	2	3	3	2
CO5	3	3	3	2	2

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Semester		CourseCode	<b>21BOTP03D3</b>
CourseTitle	<b>REPRODUCTIVEBIOLOGYOFANGIOSPERMS</b>		
No.ofCredits	3	No.ofcontacthoursper week	3
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageof revision effected (Minimum20%)	20
Category	<b>Disciplinecentric</b>		
Scope of theCourse (maybemore thanone)	<ol style="list-style-type: none"> <li>1. Comprehendtheknowledgeonsexuality ofAngiosperms</li> <li>2. Acquiretheknowledgeon phenology,pollinationandseedsbiologyofAngiosperms</li> <li>3. Understandtheimportanceofstudy onreproduction inAngiosperms</li> </ol>		
CognitiveLe velsaddresse dbythe Course	K1- Inculcate the importance of study on sexuality of AngiospermsK2-Understandthevariousstages ofAngiospermsreproduction K3-Realizetheimportanceofthisstudyin otherbotanicalresearches K4-Understanding the role of pollination and advertisement in plants biologyK5- Create awareness among the students to understand the reproductivebiologyand to appearfor national levelexaminations		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• To understand the reproductive biological mechanism of plant taxa and itsrolein conservation.</li> <li>• Toexposethestudentsontheunderstandthephenology,floralbiology,pollination, pollen-pistilinteraction,seedbiologyandanalysisonreproductive constrains of trees.</li> <li>• Createawarenessamongthestudentstounderstandthereproductivebiology andtoappearforationallevelexaminations</li> </ul>		
Unit	Content	No.of Hours	
I	<b>Reproductivebiology</b> Reproductive biology in relation with Conservation Biology, CropProductivityandReleaseofTransgenics;Phenology;populationPhenology,FloralPhenologyandCommunityPhenology.FloralMorphologyandSexuality;MorphologyofFlower,SexualityofFlowers,Plantsand Populations,CrypticSexuality,Reproductive Allocation	12	
II	<b>Pollen &amp; PistilBiology;</b> PollenProduction,pollenMorphologyPollenFertilityandViability, Pollen Vigour. Morphology and Anatomy of the StigmaandStyle, Stigma Receptivity, OvuleReceptivity	15	
III	<b>Pollination:</b> Typesandagentshelpsforpollination.FloralAttractantsandRewards, Advertisement in flower- color, shape, nectar and scent,plant-pollinatorsinterface,fieldmethodologies.Non-mutualistic	10	

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	Pollination,FloralVisitorsandPollinators,PollinationEfficiency,PollinationLimitation, Pollen TravelandGeneFlow	
IV	<b>Pollen–PistilInteraction &amp; BreedingSystems</b> EvolutionarySignificanceofthePistil,PollenGerminationandPollen Tube Growth, Pollen Tube Guidance, Double Fertilization.BreedingSystems:OutbreedingDevices,Self-Incompatibility;HeteromorphicSelf-Incompatibility, HomomorphicSelf-Incompatibility, Apomixis; Non-recurrentApomixis, RecurrentApomixis, Pollen:OvuleRatioandtheBreedingSystem, ReproductiveAssuranceThrough Autogamy.	14
V	<b>Fruitand Seed Biology;</b> Types of fruits, morphology, anatomy, types components of seeds;Seed Viability and Germination, Seed Dormancy. Seed dispersal:agents,mechanism,seedlingrecruitment;constrains,competitionand availability of resources to the seedlings. Seed Rain, Soil SeedBank.ConstraintsforSeedProduction,dispersal,SeedGerminationandseedlingestablishment	13
References	<ol style="list-style-type: none"> <li>Anderson, G. J. 1995. Systematics and reproductive biology. In:<i>Experimental and molecular approaches to plant systematics</i>.Hoch,P.C.andStephenson,A.G.(eds.).St.Louis,Mo.:Missouri Botanical Garden (Monographs in Systematic Botany).pp. 263 -272.</li> <li>Augsburger, C. K. 1982. A cue for synchronous flowering. In:<i>The ecology of a tropical forest, seasonalrhythms and long termchanges</i>. Leigh, E. G. J., Rand, A. and Windsor, D. M. (eds.).SmithsonianInstitutePress,Washington. pp. 133-150.</li> <li>Baker,H.G.,Baker,I.andOpler,P.A.1973.Stigmaticexudatesandpollination.In:<i>PollinationandDispersal</i>.Brantjes, N. B. M. and Linskens, H. F. (eds.). Department ofBotany,UniversityofNijmegen,Nijmegen, Netherlands.</li> <li>Bewly, J. D. and Black, M. 1982. <i>Physiology and biochemistryofseedrelationto germination</i>,Springer-Verlag,Berlin,Heidelberg,New York.</li> <li>Bronstein,J.L.1995.Theplant-pollinatorlandscape.In:<i>MosaicLandscapesandEcologicalProcesses</i>.Hansson,L.,Fahrig, L. and Merriam, G. (eds.), Chapman &amp; Hall, London. pp.256-258.</li> <li>Copeland, L. O. and McDonald. M. B. 1995. Principles of seedscience and technology. 3<sup>rd</sup>edition. Chapman and Hall, NewYork,pp.409.</li> <li>Dafni,A.1992.<i>Pollinationecology:Apracticalapproach</i>.OxfordUniversity Press, New York. pp. 250.</li> <li>Dafni, A., Kevan, P. G. and Husband, B. C. 2005. <i>PracticalPollinationbiology</i>,EnviroquestLtd,Cambridge,Ontario,Canada.</li> <li>Kramer, P. J. and Kozlowski, T. T. 1960. <i>Physiology of trees</i>,McGraw Hill, New York.</li> </ol>	

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	<p>10. Shivanna,K.R.andJohri,B.M.1985.<i>Theangiospermpollenstructu reandfunction</i>,WileyEasternLtdPublisher,NewDelhi.</p> <p>11. Shivanna,K.R.andRangaswamy,N.S.1992.<i>PollenBiology- ALaboratoryManual</i>, NarosaPublishingHouse, NewDelhi.</p> <p>12. Shivanna,K.R.andRajeshTandon.2014.<i>ReproductiveEcologyof FloweringPlants: A Manual</i>,Springer, India.</p>	
CourseOutcomes	<p>Oncompletionofthecourse, studentsshouldbe ableto</p> <p>CO1: understand the reproductive biological mechanism of planttaxaand its rolein conservation.</p> <p>CO2: expose the students on the understand the phenology, floralbiology,pollination,pollen-pistilinteraction,seedbiologyandanalysis on reproductiveconstrains of trees.</p> <p>CO3: Create awareness among the students to understand thereproductivebiologyandtoappearforationallevel examinations</p>	

#### Mappingof Coswith PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3

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**MODULARCOURSES**

Semester	<b>Third</b>	CourseCode	<b>21BOTP03M1</b>
CourseTitle	<b>ADVANCEDMOLECULARTECHNIQUES</b>		
No.ofCredits	2	No.ofcontacthoursper week	2
NewCourse/ RevisedCourse	RevisedCourse	Ifrevised,Percentageof revision effected(Minimum20%)	20
Category			
Scope of theCourse (maybemore thanone)	<ol style="list-style-type: none"> <li>1. Inculcatetheprincipleandapplicationsofchromatographicandspectrophotometrictechniques</li> <li>2. Learntheseparationofproteinsbyelectrophoresis</li> <li>3. Understandthe aminoacidsequencingandblottingtechniques</li> </ol>		
Cognitive Levelsaddressed by theCourse	K1-Realizethescope andapplicationsofdifferentmoleculartechniquesK2- Comparethe nativePAGEand SDS PAGE analysis K3-GainknowledgeofDNAmicroarray techniques K4-RealizetheimportanceofPCRamplificationindiseasediagnosisK5- Understand the mapping of genomein forensic studies		
CourseObjectives(Maximum:5)	Thecourseaims <ul style="list-style-type: none"> <li>• togiveknowledgeonworkingprincipleandapplicationsofelectrophoresistechniques</li> <li>• todevelopinteresttoacquirelatestinformationonmolecularsequencinganditsapplications</li> <li>• tomakeknowledgeonPCRtechniques anditsapplications</li> <li>• toimpartin-depthknowledgeonchromatographicandspectrophotometrictechniquesand their uses</li> <li>• tocreateinterestontheimportanceofgenomesequencingandphysicalmappinganalysis</li> </ul>		
Unit	Content	No.ofHours	
I	<b>Chromatographic and Spectrophotometric techniques</b> Principle and applications of Gas Chromatography (GC), HighPerformance Liquid Chromatography (HPLC). Principle and applications of Atomic Absorbance Spectra (AAS), Infra –red(IR)Spectra and LC-MS technique.	7	
II	<b>Electrophoresis:</b> Principleandapplication: paperelectrophoresis, agarosegel electrophoresis, polyacrylamidegelelectrophoresis(NativePAGEand SDS-PAGE)andImmunoelctrophoresis	7	
III	<b>MolecularSequencing</b> Amino acid sequencing and analysis -MALDI-TOF, DNasequencing –Enzymatic & chemicalmethods andnewgeneration sequencing – 16S & 18S rRNA sequencing. Blottingtechniques– Southern,northern, western andDotblots.	6	

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	Microarraytechniques– oligonucleotidearrayandcDNAarrayandits applications.	
IV	<b>PCRtechniques</b> Principle and applications- types of PCR - enzymology- primertypes-methods. PCR amplification for Detection of mutation,monitoring cancer therapy, detect bacterial & viral infections,sexdeterminationofprenatalcells, linkageanalysis insperm cellsandstudiesonmolecularevolution.	6
V	<b>Molecularmappingofgenome</b> Physical mapping and map -based cloning – choice of mappingpopulation&simplesequencerepeatloci– southernandfluorescenceinsituhybridizationforgenomeanalysis- chromosomemicrodissectionandmicrocloning- molecularmarkersingenomenalysis(RFLP,RAPD,andAFLPanal ysis) –molecularmarkerslinkeddiseaseresistancegenes– applicationofRFLPinforensic,diseaseprognosis,geneticcounsell ing, pedigree, varietal analysis, animal trafficking andpoaching- germplasmmaintenanceandtaxonomy.Molecular mappingofgenome.	6
References	TextBooks 1. Glick,B.R.andPasternak,J.J1994.MolecularBiotechnology,ASMPress, Washin gtonDC. 2. James.D.Watson,MichaelGilman,JanWitKoeskiandMarkZuller,2001.Reco mbinantDNA.IIndEd.ScientificAmericanBook, NewYork. 3. B.Lewin2000.GenesVIIIOxford UniversityPress. 4. E.J.Gardeneretal.,. 1991.PrinciplesofGenetics(8 <sup>th</sup> Ed.,)JohnWiley&Sons,Ne w York. ReferenceBooks 1. S.PalanichamyandM.Shunmugavelu2009.Researchmethodsinbiologicalscience s.Palani paramountpublications, Palani. 2. K.Kannan2003HandbookofLaboratoryculturemedia,reagents,stainsandbuffers Panima publishing corporation, New Delhi. 3. KeithWilsonandJohnWalker2002practicalbiochemistry– Principlesandtechniques.Fifthedn. Cambridge Univ. Press. 4. P.Asokan2002. Analyticalbiochemistry–Biochemicaltechniques. Firstedition– Chinnaapublications, Melvisharam, Vellore 5. RodneyBoyer,2001.ModernExperimentalBiochemistry.IIIEd.AddisonWesleyL ongman Pte. Ltd, IndianBranch,Delhi, India. E-Resources 1. <a href="http://www.cellbio.com/education.html">www.cellbio.com/education.html</a> 2. <a href="https://www.loc.gov/rr/scitech/selected-interval/molecular.html">https://www.loc.gov/rr/scitech/selected-interval/molecular.html</a>	



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	3. <a href="http://global.oup.com/uk/orc/biosciences/molbio">global.oup.com/uk/orc/biosciences/molbio</a> 4. <a href="https://www.loc.gov/rr/scitech/selected-internet/molecular.html">https://www.loc.gov/rr/scitech/selected-internet/molecular.html</a>
Course Outcomes	On completion of the course, students should be able to CO1: Outline the working principle and applications of electrophoresis techniques CO2: Explain molecular sequencing techniques CO3: Discuss PCR techniques and their applications CO4: Uses of chromatographic and spectrophotometric techniques CO5: Demonstrate methods involved for genome sequencing and physical Mapping

#### **Mapping of Cos with PSOs**

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	1	2	2
CO2	2	2	1	2	2
CO3	2	2	1	2	2
CO4	2	2	1	2	2
CO5	2	2	1	2	2

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Semester	<b>Third</b>	CourseCode	<b>21BOTP03M2</b>
CourseTitle	<b>BIOINFORMATICS</b>		
No.ofCredits	2	No.ofcontacthoursper week	2
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageofrevisionef fected	
Category	ModularCourse		
Scope of theCourse (maybemore thanone)	<ol style="list-style-type: none"> <li>1. Understandthebasicsof bioinformatics</li> <li>2. Learntheanalysisofsequencebycomputationalmethods</li> <li>3. Knowtheimportanceof proteinandnucleic acidatabases</li> </ol>		
CognitiveLe velsaddresse dbythe Course	K1-Analyzethevarious toolsused inbioinformatics K2 - Realize the use of computer in biological applicationsK3 - Gain knowledge on detecting DNA polymorphismsK4-Realizetheimportanceofmolecular dockinganalysis K5-Understandthe significanceofproteindatabases		
CourseObject ives(Maximu m:5)	Thecourseaims <ul style="list-style-type: none"> <li>• tostudyonBioinformatics,microbialgenomicsandproteomics</li> <li>• tounderstandgenomeanalysis,sequenceanalysisandproteinanalysis</li> <li>• toexplain thetools used inBioinformatics</li> <li>• toimpartinformationonacomprehensiveglobalviewonDNAsequence,DNAexpres sionand molecularconfirmations</li> <li>• toknowcomputationalbiology</li> </ul>		
Unit	Content	No.ofHours	
I	<b>Wholegenomeanalysis</b> Preparationoforderedcosmidlibraries,bacterialartificial chromosomelibraries,shotgunlibrariesandsequencing.	6	
II	<b>Sequenceanalysis</b> Computational methods, homology algorithms (BLAST) forproteinsandnucleic acids.PROSITE,PEAM,andProfileScan.	6	
III	<b>DatabasesAnalysis</b> Useofinternet,publicdomaindatabasesfornucleicacidandprote insequences(EMBL, GenBank);databasefor protein structures(PDB).	6	
IV	<b>DNAmicroarrayandgeneralAnalysis</b> DNA microarray printing or oligonucleotides and PCR products onglass slides, nitrocellulose paper.Whole genome analysis forglobal patterns of gene expressions using fluorescent labeled DNAorend labeled RNA probes.Analysis of singlenucleotide polymorphismsusingDNAchips.	7	
V	<b>ProteinanalysisandProteomics</b>	7	

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	Sequence analysis of individual protein spots by mass spectroscopy. Protein microarray. Advantages and disadvantages of DNA and protein microarrays. Introduction to docking.
References	<p>Text Books</p> <ol style="list-style-type: none"> <li>1. Read, TD., Nelson, KE., Fraser, CH. 2004. Microbial Genomics. Humana Press Inc., USA.</li> <li>2. Rashidi, H.H. and Buchler, L.K. 2002 Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London</li> <li>3. Stephen P. Hont and Rick Livey (OUP) 2000. Functional Genomics, A practical Approach.</li> <li>4. Perysju, Jr. and Peruski 1997. The Internet and the New Biology: Tools for Genomic and molecular Research.</li> <li>5. Mark Schena (OUP). DNA Microarrays, A practical approach.</li> </ol>
	Reference Books
	<p>E-Resources</p> <ol style="list-style-type: none"> <li>1. <a href="https://www.bioinformatics.org">https://www.bioinformatics.org</a></li> <li>2. <a href="http://bioinformaticsonline.com">bioinformaticsonline.com</a></li> <li>3. <a href="http://www.ii.uib.no/~inge/list.html">www.ii.uib.no/~inge/list.html</a></li> </ol>
Course Outcomes	On completion of the course, students should be able to
	<p>CO1: Evaluate whole genome analysis methods</p> <p>CO2: Apply the computational tools used for sequence analysis tools</p> <p>CO3: Demonstrate the use of internet in data analysis</p> <p>CO4: Acquire knowledge on DNA microarray techniques</p> <p>CO5: Familiar with the different methods of protein analysis</p>

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	2	3	3	2
CO3	3	2	3	3	3
CO4	3	2	3	3	2
CO5	3	3	3	3	2

M.Sc.BotanySyllabus(July2021onwards)

Semester	<b>Third</b>	CourseCode	<b>21BOTP04M3</b>
CourseTitle	<b>RURALBIOTECHNOLOGY</b>		
No.of Credits	2	No.ofcontacthoursper week	2
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageofrevisionef fected	20
Category	ModularCourse		
Scope of theCourse (maybemore thanone)	<ol style="list-style-type: none"> <li>1. Understandtheimportanceofbiogas technology</li> <li>2. Learntheeffectiveway ofutilizationofvermicompost</li> <li>3. Fieldobservationofmushroomfarms, spirulinaindustriesand fishfarms</li> </ol>		
CognitiveLevelsaddresse dbythe Course	K1 -Create awareness on utilization of bioresources for rural economy K2 - Remember the scope and applications of biogas and vermiculturetechnology K3-Gainknowledgeonmushroom cultivation K4-Assess thetechniques for spirulinacultivation K5-Analyzethe importanceof biotechnologyinenhancing ruraleconomy		
CourseObjectives(Maximum:5)	<b>Thecourseaims</b> <ul style="list-style-type: none"> <li>• tocreateinterestonthefundamentalsofbiogastechnology</li> <li>• toexposethe technologiesrelated tocomposting</li> <li>• toimpartinformation onscopeofmushroom culturetechnology</li> <li>• toimpartknowledgeon<i>Spirulina</i>cultivationontechnology</li> <li>• toknowOrnamentalFishculturetechnology</li> </ul>		
Unit	Content	No.ofHours	
I	<b>Biogastechnology</b> Introductionandhistory–anaerobicdigestion–microbesinvolved –factorsinfluencingmethaneproduction–Stagesofmethanegeneration – Wastes used in methanogenesis – various bioreactorsusedformethanegeneration– Advantagesanddisadvantages.Visit tobiogasproductionunitswithfield demonstration.	7	
II	<b>Compostingtechnology</b> Historical background – waste availability – factors influencing – methods-biomaturity-enrichmentofCompostandcropproductivity. Vermiculture Technologies: History – species – lifecycles– methods– differenttypesofwastesuitableforvermicomposting.Utilizationofvermicompostforcropproduction. Visittovermicompostindustrieswithfielddemonstration.	7	

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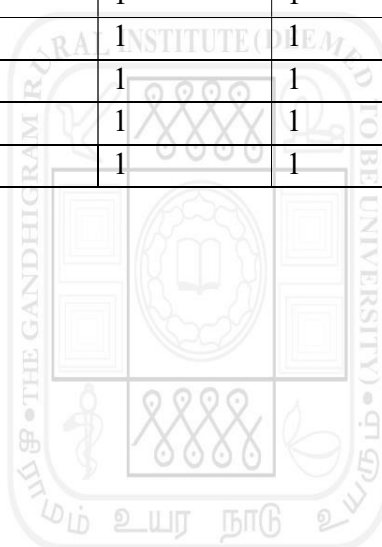
III	<p><b>Mushroom technology</b>                      Bioconversion of organic wastes into protein-                      Oyster mushroom technology, paddy mushroom technology, milk mushroom and                      button mushroom technology, postharvest technology. Mushroom farming                      and prospects. Visit to mushroom farms with field demonstration.</p>	6
IV	<p><b>Spirulina cultivation technology</b>                      Biology of <i>Spirulina</i> - cultivation methods, post harvest technology and single cell protein formulation. Visit to <i>Spirulina</i> industries with field demonstration.</p>	6
V	<p><b>Ornamental Fish culture</b>                      Present status and importance – popular varieties – Natural, artificial and live feeds – breeding techniques of egg layers – gold fish, angelfish, fighter and barbs – live bearers – guppy, molly, platy and swordtail – Economics.</p>	6
References	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. Tripathi, G. 2003. Vermire source technology, 1<sup>st</sup> Ed., Discovery Publication House, New Delhi.</li> <li>2. Anita Saxena, 2003. Aquarium management. Daya Pub. House, New Delhi.</li> <li>3. Kaul, T.N. 1999. Introduction to mushroom science, Oxford &amp; IBH Co., Pvt. Ltd., New Delhi.</li> <li>4. Kumar, H.D., 1991. A Textbook on Biotechnology, II Edition, East-west Press Pvt. Ltd., New Delhi.</li> <li>5. Chawla O.P. 1986. Advances in Biogas Technology, ICAR, New Delhi.</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Srivastava, C.B.L., 2002. Aquarium fishkeeping. Kitab Mahal, Allhabad.</li> <li>2. Gaur, A.C., 1999. Microbial technology for Composting of Agricultural Residues by Improved Methods, 1<sup>st</sup> print, ICAR, New Delhi.</li> <li>3. Subba Rao, N.S., 1999. Soil Microbiology, 4<sup>th</sup> Ed., Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.</li> <li>4. Philip G. Miles, Shu-Ting Chang, 1997. Mushroom biology, World Scientific, Singapore.</li> <li>5. Chatwal, G.R., 1995. Textbook of Biotechnology, Anmol Publications Pvt. Ltd., New Delhi</li> <li>6. Bahl, N. 1988. Handbook on mushrooms. Oxford &amp; IBH Publishing Co., Pvt. Ltd., New Delhi.</li> </ol>	

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	<p>E-Resources</p> <ol style="list-style-type: none"> <li>1. <a href="https://www.eesi.org">https://www.eesi.org</a></li> <li>2. <a href="https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html">https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html</a></li> <li>3. <a href="https://www.rpcau.ac.in">https://www.rpcau.ac.in</a></li> <li>4. <a href="https://www.techno-preneur.net">https://www.techno-preneur.net</a></li> <li>5. <a href="https://www.ncdc.in/">https://www.ncdc.in/</a></li> </ol>
Course	Oncompletionofthecourse, studentsshouldbe ableto
Outcomes	<p>CO1:Evaluate the different aspects of biogas production technology</p> <p>CO2:Discuss the different types of composting technologies and how to establish a composting units</p> <p>CO3: Explain the methods of mushroom culture and start a mushroom farm</p> <p>CO4: Summarise <i>Spirulina</i> cultivation by low-cost method</p> <p>CO5: Understand the culture technique of different ornamental fish and establish an aquarium farm</p>

#### Mapping of Cos with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	3
CO2	3	3	1	1	3
CO3	3	3	1	1	3
CO4	3	3	1	1	3
CO5	3	3	1	1	3



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Semester	<b>Fourth</b>	CourseCode	<b>21BOTP04M4</b>
CourseTitle	<b>COMMERCIALPLANTTISSUECULTURE</b>		
No.ofCredits	2	No.ofcontacthoursper week	2
New Course/Revised Course	NewCourse	If revised, Percentage ofrevisioneffected(Minimum 20%)	20
Category	Modular		
Scope of theCourse (maybemorethanone)	<ul style="list-style-type: none"> <li>• Understandvariousmedia,sterilization,totipotency,cellinduction,organogenesis of plant tissueculture</li> <li>• Applythe techniquestodevelopa standard protocolforPlantTissueCulture</li> <li>• Have comprehensive knowledge on GM technology, bio-safety relations andgermplasmstorage</li> <li>• Acquire the knowledge on various stages of plant tissue culture and to becomeaindustrialist</li> </ul>		
CognitiveLevelsaddressedbythe Course	K1-Inculcatetheimportanceofplanttissueculture K2-Examinetheofvarious stagesof planttissueculture K3-Implementtheprocessofvariousstages ofplanttissuecultureinothrobotanicalresearches K4-Identifythenovelmethologytohigherplantproduction K5- Create awareness among students to understand the various stages of planttissuecultureand to become ainustrialist		
CourseObjectives(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Tounderstand thebasicprinciplesand methodologiesofplanttissue culture</li> <li>• Tounderstandthedifferentstandard protocolfortheproductionofviableclones</li> <li>• TolearntheknowledgeonvariousmethodsofTissueCultureandsecondarymetabolitesproduction.</li> </ul>		
Unit	Content	No.of Hours	
I	<b>Introductiontoplanttissueculture.</b> Concept and history of plant tissue culture; pioneering work andsignificantachievementsofIndianscientists.Planttissueculturelaboratorydesign;basicrequirementsandsterilizationpractices,Explantsselection,sterilizationandinoculation;Variousmedia preparations;MS,B5, SHPCL-2;	12	
II	<b>Planttissueculturetechnique</b> Washing, packing and sterilization of glassware; composition, types,preparation and sterilization of culture media; selection, isolation,surface sterilization and inoculation of explants; establishment of <i>invitro</i> cultures,idealconditionsforincubationofcultures,maintenanceofculturesandsubculture;regenerationofplantlets; acclimatizationoftissue culturedplantletsingreenhouse/polyhouse.	15	

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III	<p><b>Cellulartotipotencyanddifferentiation</b>            Concept of cellular totipotency and differentiation (dedifferentiationandredifferentiation);roleofplantgrowthregulatorsintissueculture; role of meristems in tissue culture; characteristics of callustissue;somaclonalvariation;organogenesisandsomaticembryogenesis.Preparationofsyntheticseeds.</p>	10
IV	<p><b>Principle,protocolandapplicationtypesofculture:</b>            callus culture, meristem culture, embryo culture, root culture, antherand pollen culture; micro-propagation. Cell Suspension Culture - methodsforisolationofsinglecells,testingviabilityofcells,protocol for cell suspension culture, types of suspension cultures(batchandcontinuous),growthpattern ofcellsinbatchculture,methodsformeasurementofgrowthofcellsinsuspensionand applicationsofcellsuspensioncultures.</p>	14
V	<p><b>CommercialproductionofcropsbyTissueculture</b>            CommercialPlanttissuecultureindustriesinworldinIndiacommercial,ornamentalandmedicinalcropspropagated,Propagation of Horticultural &amp; Floriculture crops; Production of cutflowersandhomefloriculture.Diseaseandpestcontrollinggardening-Fungicides and pesticides. Plant growing problems andtheircontrol,coldhousestorage.PropagationofBanana,Sugarcane, Papaya,Mangoand someMedicinaland Aromaticplants.</p>	13
References	<p><b>TextBooks</b>            1. Kesavachandran, R. and Peter, K.V. 2008. Plant Biotechnology:Methods in Tissue cultute and gene transfer. University Press Ltd.Hyderabad.            2. Bhojwani , S.S. and Razdan , M.K. 1996. Plant Tissue Culture :Theory and Practice (revised edition). Elsevier Science Publishers,NewYork,USA            3. Jain, S.M.Sopory, S.K. and Veilleux, R.E.1996. In Vitro HaploidProduction in HigherPlants, Vols. 1-5, Fundamental Aspects andMethods.KluwerAcademicPublishers,Dordrecht,TheNetherlands            4. Bhaojwani,S.S.1990,PlantTissueCulture:ApplicationsandLimitationsElsevier SciencePublishers ,NewYork, USA            5. Kartha,K.K.1985.CryopreservationofPlantCellsandOrgans.CR CPress, Boca Raton, Florida, USA.  <b>ReferenceBook</b>            Vasil,I.K.andThorpe,T.A.1994.PlantCellandTissueCulture.KluwerAcademicPublishers, TheNetherlands.</p>	



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Course Outcomes	On completion of the course, students should be able to CO1: To understand the basic principles and methodologies of plant tissue culture CO2: To understand the different standard protocol for the production of viable clones	
	CO3: To learn the knowledge on various methods of Tissue Culture and secondary metabolites production	

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2
CO2	3	2	3	2	2
CO3	3	2	2	2	3
CO4	3	2	3	2	2
CO5	3	3	2	2	3



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Semester		CourseCode	<b>21BOTP04M5</b>
CourseTitle	<b>INTELLECTUALPROPERTYRIGHTS</b>		
No.ofCredits	2	No.ofcontacthoursper week	2
NewCourse/ RevisedCourse	NewCourse	If revised, Percentage ofrevision effected (Minimum20%)	-
Category	Modular		
Scope of theCourse (maybemorethanone)	1. UnderstandtheimportanceofIntellectualpropertyRights 2. Acquire the knowledge on Copyright, Trademarks and Registration of patentsforinnovations 3. UnderstandtheProcessofpatentabilityandIPRopportunitiesinlifesciences		
CognitiveLevelsaddressed bythe Course	K1- Inculcatetheimportanceof IPR K2-ExaminationofCopyrightandTrademarksandRegistrationofIPRs K3- Implement the process ofpatent application K4-Motivatetheinnovations to getcopyrights K5-Create awarenessamongthepeopleonpatentapplicationprocess		
CourseObjectives(Maximum:5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• ToevaluatedknowledgeonIntellectual propertyRights</li> <li>• TounderstandtheCopyrightandTrademarksandRegistrationofIPRs</li> <li>• Toevaluatetheprocessof Patents&amp;Patentability</li> <li>• Toanalysethedetailsof various processof IPRinLifeSciences</li> </ul>		
Unit	Content		No. ofHours
<b>I</b>	<b>IntroductiontoIPRs.</b> BasicconceptsandneedforIntellectualproperty-Patents, Copyrights, Geographical Indications, Nature ofIntellectualProperty,IndustrialProperty,technologicalResearch. Introduction to Intellectual property – Invention and Creativity – Importance– Protection ofIPR		6
<b>II</b>	<b>CopyrightandTrademarksandRegistrationof IPRs:</b> Copyright – definition, protection, Related Rights, Distinction between relatedrightsandcopyrights.NatureofCopyright-Subjectmatterofcopyright:originalliterary,dramatic,musical,artisticworks;cinematograph films and sound recordings. Trade mark – definition,rights,kindofsigns,typesoftrademarks,protectionandregistration.		6
<b>III</b>	<b>Patents:</b> Introduction to Patents – Patentability criteria - Novelty,NonObviousnessandindustrialapplicability-ThePatentAct,1970 – Inventions not patentable – Patent Specifications: Provisional andcomplete - Types of patent applications – compulsory licensing – PatentapplicationFormsandfees–Patentsearch-Types.Patents:		7

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<b>IV</b>	<p><b>Patents &amp; Patentability;</b> Patents- Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application</p> <p>- Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies &amp; Penalties</p>	7
<b>V</b>	<p><b>IPR in Life Sciences:</b> Patentability of Biotechnology Inventions - Protection of Genetic Resources - Patenting of seeds Moral Issues in Patenting Biotechnological Inventions – case studies on biotechnology patents Legal protection of Biotechnological inventions. Patenting of Basmati Rice in USA, case study of Glyphosate tolerance, betaine production and revocation of Neem and Turmeric patents.</p>	6
<b>References</b>	<ol style="list-style-type: none"> <li>1. Deborah E. Bouchoux- Intellectual: The Law of Trademarks, Copyrights, Patents and Trade secrets, Cengage Learning. Third Edition, 2012</li> <li>2. Prabuddha Ganguli Intellectual Property Rights: Unleashing the knowledge Economy. McGraw Hill Education, 2011</li> <li>3. Edited by Derek Bosworth and Elizabeth Webster. The Management of Intellectual Property. Edward Elgar Publishing Ltd., 2013.</li> <li>4. Baine. (2007). Biotechnology from A to Z, Agrobios, New Delhi.</li> <li>5. Barum. (2006). Biotechnology, Thompson Publishers, New Delhi.</li> <li>6. Chawla, H.S. (2007). Introduction to Plant Biotechnology. Oxford and IBH publishing Co(P) Ltd. New Delhi.</li> <li>7. Das, H.K. (2010). Textbook of Biotechnology. Wiley India (P) Ltd. New Delhi.</li> <li>8. Dubey, R.C. (2010). Textbook of Biotechnology, S. Chand and Co. Ltd., Ramnagar, New Delhi.</li> <li>9. Prabuddha Ganguli (2017). Intellectual Property Rights: Unleashing the Knowledge Economy. McGraw Hill Education</li> <li>10. R. Radhakrishnan and S. Balasubramanian (2008). Intellectual Property Rights: Text and Cases. Excel books</li> <li>11. B.L. Wadehra (2016) Law relating to Intellectual Property, 2011. Universal Law Publishing – An imprint of Lexis Nexis, 5<sup>th</sup> Edition</li> <li>12. Verma, S. K. and Mohit Verma, (2010). Textbook of Plant Physiology, Biochemistry and Biotechnology. S. Chand and Co. New Delhi.</li> <li>13. P. Narayanan (2010). Law of Copyright and Industrial Designs; Eastern Law House, Delhi,</li> <li>14. T. M. Murray and M. J. Mehlman, (2000). Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley &amp; Sons/</li> <li>15. Nithyananda, K.V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.</li> <li>16. Neeraj, P., &amp; Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI Learning Private Limited.</li> </ol> <p><b>Reference book:</b></p> <ol style="list-style-type: none"> <li>1. Ahuja, V.K. (2017). Law relating to Intellectual Property Rights.</li> </ol>	

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	<p style="text-align: center;">India,IN:LexisNexis.</p> <p><b>E-resources:</b></p> <ol style="list-style-type: none"> <li>1. Subramanian,N.,&amp;Sundararaman,M.(2018).IntellectualProperty Rights–AnOverview.Retrievedfrom<a href="http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf">http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf</a></li> <li>2. WorldIntellectualPropertyOrganisation.(2004).WIPOIntellectual propertyHandbook.Retrievedfrom<a href="https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf">https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf</a></li> </ol> <p><b>ReferenceJournal:</b></p> <ol style="list-style-type: none"> <li>1.JournalofIntellectual PropertyRights(JIPR):NISCAIR</li> </ol> <p><b>UsefulWebsites:</b></p> <ol style="list-style-type: none"> <li>1. CellforIPRPromotionandManagement(<a href="http://cipam.gov.in/">http://cipam.gov.in/</a>)</li> <li>2. World Intellectual Property Organization(<a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a>)</li> <li>3. OfficeoftheControllerGeneralofPatents,Designs&amp;Trademarks(<a href="http://www.ipindia.nic.in/">http://www.ipindia.nic.in/</a>)</li> </ol>	
	<p>On completion of the course, students should be able to</p> <p>CO1: gaintheknowledgeonIntellectualpropertyRights</p> <p>CO2: understandtheCopyrightandTrademarksandRegistrationof IPRs</p> <p>CO3:evaluatethe processof Patents&amp;Patentability</p> <p>CO4:analysethedetailsofvarious processofIPRin LifeSciences</p>	

### MappingofCoswithPSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	2	3	3	3
CO3	3	3	3	3	2
CO4	3	2	3	3	3
CO5	2	3	3	3	2

M.Sc.BotanySyllabus(July2021onwards)

**Genericcourses**

Semester	Second	CourseCode	21BOTP02G1
CourseTitle	<b>HERBALBOTANYANDDIETETICS</b>		
No.ofCredits	2	No.ofcontacthoursper week	2
NewCourse/ Revised Course	NewCourse	Ifrevised,Percentageof revision effected (Minimum20%)	25
Category	Core		
Scope of theCourse (maybemoret hanone)	1. Understandtheimportanceof herbalbotanyanddietetics 2. Utilizethenaturalresources fordaytoday lifeforbetterhealth 3. Realizetheimportanceofthecourseandpromoteresearchinbotanicalandnutrition sciences		
CognitiveLe velsaddresse dbythe Course	K1-Understandtheimportanceof botanicalherbs andfood. K2-Observationon Methodsofpreparation ofdrugsforhumankind K3- Understanding themechanismofpharmacognosy&Pharmacologicalactionofplant drugs K4-Realizethenutritionalstatus ofvarious foodhabits. K5-Awarenessamongthepeople ondietarymanagementinFever		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Toacquiretheknowledgeon importance and usageof medicinalplants</li> <li>• Tounderstandthetechniqueson Methodsofpreparationofdrugs</li> <li>• ToevaluatethemechanismofPharmacognasicalandPharmacologicalactio nofplant drugs</li> <li>• ToAssessnutritionalstatusofvariousfood itemsofhuman</li> <li>• TorealizethevariousaspectsofDietary management</li> </ul>		
Unit	Content	No.of Hours	
<b>I</b>	<b>Briefhistory of medicinal plants.</b> Briefhistoryandscopeofrawdrugsofplantorigin.Herbals,classification anddescription.Classificationofvegetabledrugs.IndiansystemsofMedi cine:Siddha,AyurvedhaandUnaniandNaturopathy. Traditional and Folklore medicine. Ethnobotany andEthnomedicine;HerbalhomeremediesofSouthIndia;Herbalformul aries-Infusionsanddecoctions,oilextractions,ointments, lotions,washes,suppositories;EthnobotanyofSouthIndia.	12	
<b>II</b>	<b>Methodsofpreparationofdrugs</b> Definition of Drug - Classification of natural drugs: Alphabetical,Morphological, Pharmacological and Chemical. Factors involved intheproductionofdrugs- climate;cultivatedandwildplants- collection,dryingandstorage.Deteriorationofdrugs-primary factors,mouldandbacterialattack,controlofinsectpests.Methods	15	

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	of preparation of drugs from various plant materials – extraction of plant material (including the traditional method of preparation) – separation and isolation of constituents – distillation, chromatography – TLC. Drug adulteration, Drug evaluation, Chemical evaluation and Biological evaluation of drugs.	
<b>III</b>	<b>Pharmacognosy &amp; Pharmacological action of plant drugs</b> Basic study of the source and medicinal value of the phytochemicals, glycosides, alkaloids, phenols, saponins and steroidal saponins. Chemistry of drugs (Alkaloids, Flavonoids, Glycosides and Tannins) Quality control of the herbal drugs. Pharmacognosy - Definition and scope. A brief account on drugs acting on central nervous system (CNS stimulants, CNS depressants and Hallucinogenics). Drugs used in disorders of gastrointestinal tract (Carminatives, Bulk laxatives and Purgatives) and cardiovascular drugs (Cardiotonics, Cardiac depressants and Antihypertensives).	10
<b>IV</b>	<b>Assessment of nutritional status:</b> Nutritional assessment, Importance and Objectives, Indirect assessment of Nutritional status- Age, specific mortality rates, causes specific mortality rates, nutritionally relevant morbidity rates, ecological factors. Direct assessment of nutritional status- Nutritional Anthropometry- Height, length, weight, waist circumference, waist hip ratio, body fat, skin fold measurements. Clinical assessment of Nutritional disorders, Biochemical assessment for nutritional deficiencies and Dietary assessment- Family diet survey, Individual diet survey, quantitative diet surveys, Institutionalised surveys and Food balance sheet.	14
<b>V</b>	<b>Dietary management:</b> Types, metabolic changes, dietary management. Dietary management in Human Immunodeficiency Disease (AIDS): pathophysiology, etiology and classification, manifestations and stages of HIV infection, opportunistic infections and other complications, pediatric consideration, relationship between malnutrition and AIDS, medical nutrition therapy. Diet in Overweight/Obesity: Aetiology, assessment, types, complications, management of obesity – medical, nutritional, lifestyle management, Diet in Diabetes Mellitus- Types, GDM, aetiology, symptoms, prevention of MODY diagnosis, treatment- insulin, oral hypoglycemic agents, dietary modifications, glycemic index, factors affecting glycemic index, glycemic load, sweeteners, complication of diabetes.	13

## M.Sc.BotanySyllabus(July2021onwards)

References	<ol style="list-style-type: none"> <li>1. Amruth, The Medicinal plants Magazine (All volumes) MedplantConservatorySociety, Bangalore.</li> <li>2. Arumugam,K.R.andMuruges,N.(1990).TextbookofPharmacognosy. Sathya Publishers, Chinnalapatti (Tamilnadu) 624201.</li> <li>3. Bhattacharjee, S.K. 2004. Hand Book of Medicinal plants. PointerPublishers,Jaipur.</li> <li>4. Gokhale,S.B.,Kokate,C.K.andPurohit,A.P.(2003).Pharmacognosy.NiraliPrakashan, Pune.</li> <li>5. GuhaBakshi,D.N.SenSharma,P.andPal,d.C.(1996).ALexiconofMedicinal Plantsin India. NayaPrakash,Calcutta.</li> <li>6. Handa,S.S.andV.K.Kapoor,(1993).Pharmacognosy.VallabhPrakashan.NewDelhi.</li> <li>7. Harbourne, J. B. (1998). Phytochemical methods: A Guide toModern Techniques of Plant Analysis (3<sup>rd</sup>edition). Chapman andHillCo., New York.</li> <li>8. Jain,(2001).Medicinalplants.NationalBookTrust,NewDelhi.</li> <li>9. John JothiPrakash, E. (2003). Medicinal Botany andPharmacognosy.JPR Publication,Vallioor, Tirunelveli.</li> <li>10. Joshi,S.G.(2001).Medicinalplants.Oxford&amp;IBHPublishingCo.Pvt. Ltd., New Delhi.</li> <li>11. MedicinalPlantsSourceBookIndia,(1996).InternationalLibraryAssociation, Switzerland.</li> <li>12. Prajapathi,Purohit,SharmaandKumar.(2003).AHandbookofMedicinalplants. Agrobios Publications, Jodhpur.</li> <li>13. PurohitandVyas,(2004).MedicinalPlantsCultivation.AgrobiosPublications, Jodhpur.</li> <li>14. Thirugnanam, (1995). Muligaimaruthuvam (Tamil).Selvipathipakam,Trichy.</li> <li>15. Saroya AS. 2011. Herbalism, Phytochemistry andEthnopharmacology,CRC Press, U</li> <li>16. Chopra,R.N.Nager,S.L.andChopra,I.C.1956.GlossaryofIndianMedicinal Plants. CSIR, NewDelhi.</li> <li>17. Nadkarni, K.M. 1982. Indian MateriaMedica. PopularPrakashamPvt. Ltd.</li> <li>18. Trease, G.E. and Evans, W.C. 1980. Text Book ofPharmacognosy.ELBS, Bailliere, Tindall.</li> <li>19. Sambamurthy,A.V.S.S.andSubramanian,M.S.1989.AtextbookofEconomicBotany. WileyEastern Co., New Delhi.</li> <li>20. Wallis,T.E. 1985. Text Book of Pharmacognosy. CBS PublishersandDistributors,NewDelhi</li> </ol>
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	<p>21. Rantia P. Clinical Dietetics and Nutrition, 2<sup>nd</sup> edition, Oxford University press.</p> <p>22. Garrow J.S, James W.P.T, Ralph A, (2000), Human Nutrition and Dietetics, 10<sup>th</sup> edition, Churchill Livingstone, London.</p> <p>23. Guthrie H.A, Picciano M.F (1995), Human Nutrition, Mosby, St. Louis.</p> <p>24. Michael Sharon. 1994, Complete Nutrition, Avery publishing group. New York.</p> <p>25. Mohan K. L, Krause M.V. 2002, 2<sup>nd</sup> edition Food, nutrition and Diet Therapy, W.S. Saunders Co, Philadelphia.</p> <p>26. Srilakshmi B, Dietetics .2006. New age International publishing Ltd.</p> <p>27. Robinson C.H., Lawler M.R, Cheweth W.L; and Gaswick A.E, Normal and Therapeutic Nutrition, 17<sup>th</sup> edition, MacMillan Publishers.</p> <p>28. Shills M.E., Olson J:-Shike, Mand Roos, C. 1998. Modern Nutrition in Health and Disease 9<sup>th</sup> Edition. Williams and Williams A Beverly Co. London.</p> <p>29. Srilakshmi B. 2008: Nutrition Science, New age international P.Ltd., New Delhi.</p>	
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>CO1: acquire the knowledge on importance and usage of medicinal plants</p> <p>CO2: understand the techniques on Method of preparation of drugs</p> <p>CO3: evaluate the mechanism of Pharmacognosical and Pharmacological action of plant drugs</p> <p>CO4: assess nutritional status of various food items of human</p> <p>CO5: realize the various aspects of Dietary management</p>	

#### Mapping of Cos with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	2	2
CO5	2	3	3	3	2



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Semester	Fourthsemester	CourseCode	21BOTP02G2
CourseTitle	<b>PRESERVATIONANDPROCESSINGOFFRUITSandVEGETABLES</b>		
No.ofCredits	<b>Credits-2</b>	No.ofcontacthoursper week	2
NewCourse/ RevisedCourse	NewCourse	If revised, Percentage ofrevision effected (Minimum20%)	-
Category	Core		
Scope of theCourse (maybemorethanone)	1. Understandthe conceptsof fruitsandvegetable preservation 2. Utilizethevarious methodologiesof fruits andvegetablepreservation. 3. ComprehendtheinformationonthetechniquesandmotivatethestudentstobecomeEntrepreneur and Industrialists		
CognitiveLevelsaddressedbythe Course	K1- Inculcatethe advancementoffruitsandvegetablepreservation K2-realizethevarioustechniques involvedin fruitsandvegetablepreservationK3- Apply the knowledgeon various techniques inIndustrial level K4-UnderstandtheproblemsandfactsoffruitsandvegetablepreservationK5- Motivate the people to become fruits and vegetable preservationEntrepreneurandIndustrialists		
CourseObjectives(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Toevaluatemethodologiesoffruitsandvegetablepreservation</li> <li>• To understandthevariousprocessingTechnologiesonfruitsandvegetablepreservation</li> <li>• ToevaluatetheprocessofCooling andFreezingtechniquesforfruits</li> <li>• Tovalidatetheimportanceofthermal dryingoffoods</li> <li>• ToidentifytheroleofpreservativesonPreserving vegetables</li> </ul>		
Unit	Content	No. ofHours	
<b>I</b>	<b>PreservationofFruitsandVegetables</b> Introduction.SafetyIssuesonthePreservationofFruitsandVegetables State of the Art, Microbial Hazards-Positive effects ofmicro-organisms in food, Negative effects of micro-organisms in food.	12	
<b>II</b>	<b>ProcessingTechnologies</b> PhysiologicalAspectsAffectingthePostharvestLifeofFruits,MinimalProcessingTechnologiesusedinfruitpreservation- WashingandSanitizingofFruits- Chlorine,ChlorineDioxide,AcidifiedSodiumChlorite,HydrogenPeroxide,Peraceticacid,PeroxyaceticAcid,TrisodiumPhosphate,ElectrolyzedWater,ozone,Minimal Processing Methods to Extend Shelf-Life of Fresh-Fruits- Refrigeration, Natural Preservatives, Blanching, UltravioletLight,Irradiation,PulsedLight,Ultrasound,HighHydrostatic Pressure,FoodPackaging.TheHurdleConcept	15	

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<b>III</b>	<p><b>CoolingandFreezing</b> CoolingandFreezingofFruitsandFruitProducts-CoolingofFruits,Pre-coolingTreatmentsandRefrigeration,ControlledandModifiedAtmosphere.NovelTechnologies:ThermalTreatments,UV-CIrradiation,MinimallyProcessedFruits,EdibleCoatings. Freezing of Fruits- The Freezing Process: Ice Formation,Homogeneous and Heterogeneous Nucleation. Recommended PackagingandIndustrialFreezingMethodsforFruits-Shelf-LifeofFrozenFruits</p>	10
<b>IV</b>	<p><b>ThermalDrying of Foods-</b> Drying Equipment and Design. Drying Mechanisms. Packing andstorage.Quality of the fresh product Consuming dried products-Dryingpotatoes,Dryingtomatoes,Dryingmangos,R&amp;DOpportunitiesinDrying. Pressure-DrivenMembraneProcesses.</p>	14
<b>V</b>	<p><b>Preservingvegetableswithpreservatives</b> Preserving vegetables with salt and/or vinegar- Preserving with salt.Jam and juice making, syrups,jellies and candied fruit- Making fruitjuices, Preparation of other fruit products. Developing a small-scalefoodprocessingenterprise-Marketingafreshorprocessedproduct, Organizingaprocessingenterprise</p>	13
<b>References</b>	<p>1.Processingandpreservationoftropicalandsubtropicalfoods:Kordylas ,J.M.(1990),MacMillanEducationLtd.,HongKong, 432p. 2. Preventionofpost-harvestfoodlosses:Fruit,vegetablesandrootcrops:FoodandAgriculturalOrganizationoftheUnitedNations(1989),Rome, 154p. 3.Preservation of fruit and vegetables: Ife Fitz James BasKuipers.(2003),Agromisa Foundation,Wageningen.44-64p 4.Fruit Preservation Novel and Conventional Technologies: AmauriRosenthal RosiresDeliza Jorge Welti-Chanes Gustavo V. Barbosa-Cánovas.(2018),233Spring Street,New York, NY10013, U.S.A1- 130p</p>	
CourseOutcomes	<p>Oncompletionofthecourse,studentsshouldbeableto CO1: evaluate methodologies of fruits and vegetable preservation CO2:understandthevariousprocessingTechnologiesonfruit sandvegetablepreservation CO3:evaluatetheprocessofCoolingandFreezingtechniquesforfruits CO4:validatetheimportanceofthermaldryingoffoods CO5:identifytheroleofpreservativesonPreservingvegetables</p>	

**Mappingof Coswith PSOs**

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	2
CO2	3	2	3	3	3
CO3	3	3	2	3	2
CO4	3	3	2	3	2
CO5	2	3	3	3	2

M.Sc.BotanySyllabus(July2021onwards)

Semester	Fourthsemester	CourseCode	21BOTP02G3
CourseTitle	<b>BIOFERTILIZERSANDMUSHROOMTECHNOLOGY</b>		
No.ofCredits	<b>Credits–2</b>	No.ofcontacthoursper week	4
NewCourse/ Revised Course	NewCourse	If revised, Percentage ofrevisioneffected(Minimu m 20%)	20
Category	Core		
Scope of theCourse (maybemoret hanone)	1. Understandthe concepts biofertilizersandMushroomproduction 2. UtilizethevariousmethodologiesofbiofertilizersandMushroomforincomegener ation. 3. Comprehendtheinformationonthetechniquesandmotivatethestudentstobecom eEntrepreneur and Industrialists		
CognitiveLe velsaddresse dbythe Course	K1- Inculcate the advancement of biofertilizers and Mushroom productionK2-realize the various techniques involved in biofertilizers and Mushroomcultivation K3-Applytheknowledgeon varioustechniquesinIndustriallevel K4-Understandtheproblemsand factsofbiofertilizersandMushroomcultivation K5-Motivatethepeople tobecomebiofertilizersandMushroomcultivation EntrepreneurandIndustrialists		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> • ToevaluateKnowledge andtechniquesofBiofertilizers • TounderstandthevariousprocessingTechnologiesof Azollacultivation • Toevaluatetheprocess ofinformationaboutmushroombiology: • Tovalidatetheimportanceof tropicalmushroomcultivation technology • Toidentify NutrientprofileofMushrooms		
Unit	Content	No.of Hours	
<b>I</b>	<b>Biofertilizers</b> Introduction, scope. A general account of plant growth promotersand regulators – Cyanobacterial Biofertilizer: Algalization – masscultivation of cyanobacterial biofertilizers. Nitrogen fixing Bacteria:Isolation,characterization,identification,masscultivationandi noculationmethodof <i>Rhizobium</i> and <i>Azospirillum</i> .Mechanismof nitrogenfixation(free-livingandsymbiotic)	12	
<b>II</b>	<b>Azollacultivation</b> StructureandMorphology– MasscultivationmethodandApplication.EconomicandEcologicalimp ortanceofAzolla.PhosphatesolubilizingBacteria:Isolation,characteriz ation,identification, mass cultivation and inoculation method of Phosphobacteria.Mycorrhizalfungiasbiofertilizers-Introduction,	15	

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	scope.AgeneralaccountofEcto,EndoandArbuscularmycorrhizae (AM). Isolation and method of inoculation of Arbuscularmycorrhizae(AM), Legume-AM interactions.	
<b>III</b>	<b>Introductiontomushroombiology:</b> characteristics,importanceofmushrooms- asfood,tonicsandmedicines.Differentpartsofatypicalmushroom.Keyt odifferentiateediblefrompoisonousmushrooms.phasesofmushroomte chnology-pureculture,spawn,preparationofcompost,mushroom development	10
<b>IV</b>	<b>Prospectsoftropicalmushroom cultivationtechnology:</b> Oystermushroomtechnology,paddymushroomtechnology,milky mush room and button mushroom technology, postharvest technology.Mushroomfarmingandprospects.	14
<b>V</b>	<b>Nutrientprofileof Mushrooms;</b> Protein, aminoacids, calorific values, carbohydrates , fats, vitamins&minerals. In therapeutic diets for adolescence, for aged persons &diabetesmellitus.Healthbenefits:Antiviralvalue,antibacterialeffect, antifungal effect, anti-tumour effect, haematological value,cardiovascularandrenal effect.	13
<b>References</b>	<b>ReferenceBooks</b> 1. Kannaiyan,S.,Kumar,K.andGovindarajan,K.,2010.Biofertilizers Technology. ScientificPublishers. 2. Kumar,R.,Kumawat,N.andSahu,Y.K.,2017.Roleofbiofertilizersi n agriculture. Popularkheti, 5(4), pp.63-66. 3. Rao,N.S.,1982.Biofertilizers.Interdisciplinarysciencereviews,7(3) ,pp.220-229. 4. Verma,A. (1999).Mycorrhiza.SpringerVerlag,Berlin. 5. Subba Rao, N.S. (1982). Advances in Agricultural Microbiology.Oxford&IBH Publishing Co.Pvt. Ltd., New Delhi. 6. NiirBoard,2004.TheCompleteTechnologyBookOnBioFertilizera ndOrganicFarming,NationalInstituteOfIndustrialResearch,Delhi. 7. Reddy,G.C.,Goyal,R.K.,Puranik,S.,Waghmar,V.,Vikram, K.V.andSruthy,K.S.,2020.Biofertilizerstowardsustainableagricultur aldevelopment.Plantmicrobesymbiosis.Springer,Cham,pp.115-128. 8. Dudeja, S.S., Singh, N.P., Sharma, P., Gupta, S.C., Chandra, R.,Dhar,B.,Bansal,R.K.,Brahmaprakash,G.P.,Potdukhe,S.R.,Gunda ppagol,R.C.andGaikawad,B.G.,2011.Biofertilizertechnologyandpul seproduction.InBioaugmentation,biostimulationandbiocontrol(pp.43 -63).Springer,Berlin, Heidelberg.	

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	<p>9. <a href="https://www.biologydiscussion.com/essay/bio-fertilizers-types-and-importance-of-bio-fertilizers/1901">https://www.biologydiscussion.com/essay/bio-fertilizers-types-and-importance-of-bio-fertilizers/1901</a></p> <p>10. Tripathi,D.P.(2005).MushroomCultivation.Oxford&amp;IBHPublishingCo.Pvt. Ltd.,New Delhi.</p> <p>11. PhilipG.Miles,Shu-TingChang,1997.Mushroombiology, WorldScientific, Singapore.</p> <p>12. Kaul,T.N.1999.Introductiontomushrooms, Oxford&amp;IBHCO., Pvt. Ltd., NewDelhi.</p> <p>13. Bahl,N. 1988. Handbookonmushrooms.Oxford&amp;IBHPublishingCo.,Pvt. Ltd.,NewDelhi.</p>	
CourseOutcomes	<p>On completion of the course, students should be able to</p> <p>CO1:evaluate Knowledge and techniquesof Biofertilizers</p> <p>CO2:understandthe variousprocessingTechnologies ofAzollacultivation</p> <p>CO3: evaluate the process of information aboutmushroombiology:CO4:validate theimportanceoftropicalmushroomcultivationtechnology</p> <p>CO5:identify NutrientprofileofMushrooms</p>	

#### Mapping of Cos with PSOs

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	2	3	3	3	2

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ValueaddedCourses

Semester	<b>Third</b>	CourseCode	<b>21BOTP04VA1</b>
CourseTitle	<b>RURALBIOTECHNOLOGY</b>		
No.of Credits	2	No.ofcontacthoursper week	2
NewCourse/ Revised Course	RevisedCourse	Ifrevised,Percentageofrevisionef fected	20
Category	ValueaddedCourse		
Scope of theCourse (maybemore thanone)	4. Understandtheimportanceofbiogastechnology 5. Learntheeffectiveway ofutilizationofvermicompost 6. Fieldobservationofmushroomfarms, spirulinaindustriesand fishfarms		
CognitiveLe velsaddresse dbythe Course	K1 -Create awareness on utilization of bioresources for rural economy K2 - Remember the scope and applications of biogas and vermiculturetechnology K3-Gainknowledgeonmushroom cultivation K4-Assess thetechniques for spirulinacultivation K5-Analyzethe importanceof biotechnologyinenhancing ruraleconomy		
CourseObject ives(Maximu m:5)	<b>Thecourseaims</b> <ul style="list-style-type: none"> <li>• tocreateinterestonthefundamentalsofbiogastechnology</li> <li>• toexposethe technologiesrelated tocomposting</li> <li>• toimpartinformation onscopeofmushroom culturetechnology</li> <li>• toimpartknowledgeon<i>Spirulina</i>cultivationontechnology</li> <li>• toknowOrnamentalFishculturetechnology</li> </ul>		
Unit	Content	No.ofHours	
I	<b>Biogastechnology</b> Introduction andhistory – anaerobicdigestion– microbesinvolved –factorsinfluencingmethaneproduction–Stagesofmethanegeneration – Wastes used in methanogenesis – various bioreactorsused for methane generation – Advantages and disadvantages.Visittobiogas production units with fielddemonstration.	7	
II	<b>Compostingtechnology</b> Historical background – waste availability – factors influencing – methods-biomaturity-enrichmentofCompostandcropproductivity. Vermiculture Technologies: History – species – lifecycles–methods-differenttypesofwastesuitableforvermicomposting.Utilizationofvermic ompostforcropproduction.Visittovermicompostindustrieswithfield demonstration.	7	

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III	<p><b>Mushroomtechnology</b>            Bioconversion of organic wastes into protein - Oyster mushroomtechnology, paddy mushroom technology, milky mushroom andbutton mushroom technology, post harvest technology.            Mushroomfarmingandprospects. Visittomushroomfarmswithfield demonstration.</p>	6
IV	<p><b>Spirulinacultivationtechnology</b>            Biology of <i>Spirulina</i> - cultivation methods, post harvesttechnologyandsinglecellprotein formulation. Visitto <i>Spirulina</i> industrieswithfield demonstration.</p>	6
V	<p><b>OrnamentalFishculture</b>            Present status and importance – popular varieties – Natural,artificial and livefeeds– breeding techniquesofegg layers –goldfish,angelfish,fighterandbarbs–livebearers–guppy, molly, platyand sword tail–Economics.</p>	6
References	<p>TextBooks</p> <ol style="list-style-type: none"> <li>6. Tripathi,G.2003.Vermiresourcestechnology,1<sup>st</sup>Ed.,DiscoveryPublicationHouse, NewDelhi.</li> <li>7. AnitaSaxena,2003.Aquarium management.DayaPub. House,New Delhi.</li> <li>8. Kaul,T.N.1999.Introductiontomushroomscience,Oxford&amp;IBHCo.,Pvt.Ltd .,New Delhi.</li> <li>9. Kumar,H.D.,1991. ATextbookonBiotechnology,II Edition,East-westPressPvt. Ltd., New Delhi.</li> <li>10. ChawlaO.P.1986.AdvancesinBiogas Technology,ICAR,NewDelhi.</li> </ol> <p>ReferenceBooks</p> <ol style="list-style-type: none"> <li>7. Srivastava,C.B.L,2002.Aquariumfishkeeping. KitabMahal,Allhabad.</li> <li>8. Gaur,A.C.,1999.MicrobialtechnologyforCompostingofAgriculturalResiduesby ImprovedMethods,1<sup>st</sup>print, ICAR,NewDelhi.</li> <li>9. SubbaRao,N.S.,1999.SoilMicrobiology,4<sup>th</sup>Ed.,OxfordIBHPublishingCo.Pvt. Ltd., New Delhi.</li> <li>10. Philip G. Miles, Shu-Ting Chang, 1997.Mushroom biology, WorldScientific,Singapore.</li> <li>11. Chatwal, G.R., 1995.Textbook of Biotechnology, Anmol Publications Pvt.Ltd.,New Delhi</li> <li>12. Bahl, N.1988.Handbook on mushrooms. Oxford &amp;IBHPublishingCo.,Pvt.Ltd., New Delhi.</li> </ol>	

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	<p>E-Resources</p> <ol style="list-style-type: none"> <li>1. <a href="https://www.eesi.org">https://www.eesi.org</a></li> <li>2. <a href="https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html">https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html</a></li> <li>3. <a href="https://www.rpcau.ac.in">https://www.rpcau.ac.in</a></li> <li>4. <a href="https://www.techno-preneur.net">https://www.techno-preneur.net</a></li> <li>5. <a href="https://www.ncdc.in/">https://www.ncdc.in/</a></li> </ol>
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>CO1: Evaluate the different aspects of biogas production technology</p> <p>CO2: Discuss the different types of composting technologies and how to establish a composting unit</p> <p>CO3: Explain the methods of mushroom culture and start a mushroom farm</p> <p>CO4: Summarise <i>Spirulina</i> cultivation by low-cost method</p> <p>CO5: Understand the culture technique of different ornamental fish and establish an aquarium farm</p>

#### Mapping of Cos with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	3
CO2	3	3	1	1	3
CO3	3	3	1	1	3
CO4	3	3	1	1	3
CO5	3	3	1	1	3



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Semester	<b>Fourth</b>	CourseCode	<b>21BOTP04VA2</b>
CourseTitle	<b>COMMERCIALPLANTTISSUECULTURE</b>		
No.ofCredits	2	No.ofcontacthoursper week	2
NewCourse/ Revised Course	NewCourse	If revised, Percentage ofrevisioneffected(Minimu m 20%)	20
Category	ValueaddedCourse		
Scope of theCourse (maybemoret hanone)	<ul style="list-style-type: none"> <li>• Understandvariousmedia,sterilization,totipotency,cellinduction,org anogenesisof plant tissueculture</li> <li>• Applythe techniquestodevelopa standard protocolforPlantTissueCulture</li> <li>• Have comprehensive knowledge on GM technology, bio-safety relations andgermplasmstorage</li> <li>• Acquiretheknowledgeonvarious stagesofplanttissuecultureandto becomeaindustrialist</li> </ul>		
CognitiveLe velsaddresse dbythe Course	K1- Inculcate theimportanceofplanttissueculture K2-Examinetheofvarious stagesof planttissueculture K3- Implementtheprocessofvariousstagesofplanttissuecultureinotherbotanicalre searches K4-Identifythenovelmethologytohigherplantproduction K5- Create awareness among students to understand the various stages of planttissuecultureand to become ainustrialist		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Tounderstandthe basic principlesand methodologiesofplant tissueculture</li> <li>• Tounderstandthedifferentstandard protocolfortheproductionofviableclones</li> <li>• TolearntheknowledgeonvariousmethodsofTissueCultureandsecondarymetab            olitesproduction.</li> </ul>		
Unit	Content	No.of Hours	
I	<b>Introductiontoplanttissueculture.</b> Concept and history of plant tissue culture; pioneering work andsignificantachievementsofIndianscientists.Planttissueculturelabora torydesign;basicrequirementsandsterilizationpractices,Explantsselecti on,sterilizationandinoculation;Variousmedia preparations;MS,B5, SHPCL-2;	12	
II	<b>Planttissueculturetechnique</b> Washing, packing and sterilization of glassware; composition, types,preparation and sterilization of culture media; selection, isolation,surface sterilization and inoculation of explants; establishment of <i>invitro</i> cultures, ideal conditions for incubation of cultures,maintenanceofculturesandsubculture;regenerationofplantlets; acclimatizationoftissuecultured plantletsingreenhouse/polyhouse.	15	

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III	<p><b>Cellulartotipotencyanddifferentiation</b>            Concept of cellular totipotency and differentiation (dedifferentiationandredifferentiation);roleofplantgrowthregulatorsintissueculture; role of meristems in tissue culture; characteristics of callustissue;somaclonalvariation;organogenesisandsomaticembryogenesis.Preparationofsyntheticseeds.</p>	10
IV	<p><b>Principle,protocolandapplicationtypesofculture:</b>            callus culture, meristem culture, embryo culture, root culture, antherand pollen culture; micro-propagation. Cell Suspension Culture - methodsforisolationofsinglecells,testingviabilityofcells,protocol for cell suspension culture, types of suspension cultures(batchandcontinuous),growthpattern ofcellsinbatchculture,methodsformeasurementofgrowthofcellsinsuspensionand applicationsofcellsuspensioncultures.</p>	14
V	<p><b>CommercialproductionofcropsbyTissueculture</b>            CommercialPlanttissuecultureindustriesinworldinIndiacommercial,ornamentalandmedicinalcropspropagated,Propagation of Horticultural &amp; Floriculture crops; Production of cutflowersandhomefloriculture.Diseaseandpestcontrollingardening-Fungicides and pesticides. Plant growing problems andtheircontrol,coldhousestorage.PropagationofBanana,Sugarcane, Papaya,Mangoand someMedicinaland Aromaticplants.</p>	13
References	<p><b>TextBooks</b>            1. Kesavachandran, R. and Peter, K.V. 2008. Plant Biotechnology:Methods in Tissue cultute and gene transfer. University Press Ltd.Hyderabad.            2. Bhojwani , S.S. and Razdan , M.K. 1996. Plant Tissue Culture :TheoryandPractice(revisededition).ElsevierSciencePublishers,NewYork,USA            3. Jain, S.M.Sopory, S.K. and Veilleux, R.E.1996. In Vitro HaploidProduction in HigherPlants, Vols. 1-5, Fundamental Aspects andMethods.KluwerAcademicPublishers,Dordrecht,TheNetherlands            4. Bhaojwani,S.S.1990,PlantTissueCulture:ApplicationsandLimitationsElsevier SciencePublishers ,NewYork, USA            5. Kartha,K.K.1985.CryopreservationofPlantCellsandOrgans.CR CPress, BocaRaton, Florida, USA.  <b>ReferenceBook</b>            Vasil,I.K.andThorpe,T.A.1994.PlantCellandTissueCulture.KluwerAcademicPublishers, TheNetherlands.</p>	

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Course Outcomes	On completion of the course, students should be able to CO1: To understand the basic principles and methodologies of plant tissue culture CO2: To understand the different standard protocol for the production of viable clones	
	CO3: To learn the knowledge on various methods of Tissue Culture and secondary metabolites production	

#### Mapping of Cos with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2
CO2	3	2	3	2	2
CO3	3	2	2	2	3
CO4	3	2	3	2	2
CO5	3	3	2	2	3



M.Sc.BotanySyllabus(July2021onwards)

Semester	Fourthsemester	CourseCode	21BOTP0VA3
CourseTitle	<b>PRESERVATIONANDPROCESSINGOFFRUITSandVEGETABLES</b>		
No.ofCredits	<b>Credits-2</b>	No.ofcontacthoursper week	2
NewCourse/ RevisedCourse	NewCourse	If revised, Percentage ofrevision effected (Minimum20%)	-
Category	ValueaddedCourse		
Scope of theCourse (maybemorethanone)	1. Understandthe conceptsoffruitsandvegetable preservation 2. Utilizethevarious methodologiesoffruitsandvegetablepreservation. 3. ComprehendtheinformationonthetechniquesandmotivatethestudentstobecomeEntrepreneur and Industrialists		
CognitiveLevelsaddressedbythe Course	K1- Inculcatethe advancementoffruitsandvegetablepreservation K2-realizethevarioustechniquesinvolvedinfruitsandvegetablepreservationK3- Apply the knowledgeon various techniques inIndustrial level K4-UnderstandtheproblemsandfactsoffruitsandvegetablepreservationK5- Motivate the people to become fruits and vegetable preservationEntrepreneurandIndustrialists		
CourseObjectives(Maximum :5)	<b>TheCourseaims</b> <ul style="list-style-type: none"> <li>• Toevaluatemethodologiesoffruitsandvegetablepreservation</li> <li>• To understandthevariousprocessingTechnologiesonfruitsandvegetablepreservation</li> <li>• ToevaluatetheprocessofCooling andFreezingtechniquesforfruits</li> <li>• Tovalidatetheimportanceofthermal dryingoffoods</li> <li>• ToidentifytheroleofpreservativesonPreserving vegetables</li> </ul>		
Unit	Content	No. ofHours	
<b>I</b>	<b>PreservationofFruitsandVegetables</b> Introduction.SafetyIssuesonthePreservationofFruitsandVegetables State of the Art, Microbial Hazards-Positive effects ofmicro-organisms in food, Negative effects of micro-organisms in food.	12	
<b>II</b>	<b>ProcessingTechnologies</b> PhysiologicalAspectsAffectingthePostharvestLifeofFruits,MinimalProcessingTechnologiesusedinfruitpreservation- WashingandSanitizingofFruits- Chlorine,ChlorineDioxide,AcidifiedSodiumChlorite,HydrogenPeroxide,Peraceticacid,PeroxyaceticAcid,TrisodiumPhosphate,ElectrolyzedWater,ozone,Minimal Processing Methods to Extend Shelf-Life of Fresh-Fruits- Refrigeration, Natural Preservatives, Blanching, UltravioletLight,Irradiation,PulsedLight,Ultrasound,HighHydrostatic Pressure,FoodPackaging.TheHurdleConcept	15	

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<b>III</b>	<p><b>Cooling and Freezing</b> Cooling and Freezing of Fruits and Fruit Products- Cooling of Fruits, Pre-cooling Treatments and Refrigeration, Controlled and Modified Atmosphere. Novel Technologies: Thermal Treatments, UV-C Irradiation, Minimally Processed Fruits, Edible Coatings.</p>	10
	<p>Freezing of Fruits- The Freezing Process: Ice Formation, Homogeneous and Heterogeneous Nucleation. Recommended Packaging and Industrial Freezing Methods for Fruits- Shelf-Life of Frozen Fruits</p>	
<b>IV</b>	<p><b>Thermal Drying of Foods-</b> Drying Equipment and Design. Drying Mechanisms. Packing and storage. Quality of the fresh product Consuming dried products- Drying potatoes, Drying tomatoes, Drying mangos, R&amp;D Opportunities in Drying. Pressure-Driven Membrane Processes.</p>	14
<b>V</b>	<p><b>Preserving vegetables with preservatives</b> Preserving vegetables with salt and/or vinegar- Preserving with salt. Jam and juice making, syrups, jellies and candied fruit- Making fruit juices, Preparation of other fruit products. Developing a small-scale food processing enterprise- Marketing a fresh or processed product, Organizing a processing enterprise</p>	13
<b>References</b>	<p>1. Processing and preservation of tropical and subtropical foods: Kordylas, J.M. (1990), MacMillan Education Ltd., Hong Kong, 432p. 2. Prevention of post-harvest food losses: Fruit, vegetables and root crops: Food and Agricultural Organization of the United Nations (1989), Rome, 154p. 3. Preservation of fruit and vegetables: Ife Fitz James Bas Kuipers. (2003), Agromisa Foundation, Wageningen. 44-64p 4. Fruit Preservation Novel and Conventional Technologies: Amauri Rosenthal Rosires Deliza Jorge Welti-Chanes Gustavo V. Barbosa-Cánovas. (2018), 233 Spring Street, New York, NY 10013, U.S.A. 1-130p</p>	
<b>Course Outcomes</b>	<p>On completion of the course, students should be able to CO1: evaluate methodologies of fruits and vegetable preservation CO2: understand the various processing Technologies on fruit and vegetable preservation CO3: evaluate the process of Cooling and Freezing techniques for fruits CO4: validate the importance of thermal drying of foods CO5: identify the role of preservatives on Preserving vegetables</p>	

**Mapping of Cos with PSOs**

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	2
CO2	3	2	3	3	3
CO3	3	3	2	3	2
CO4	3	3	2	3	2
CO5	2	3	3	3	2

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Semester	Fourthsemester	CourseCode	21BOTP0VA4
CourseTitle	<b>BIOFERTILIZERSANDMUSHROOMTECHNOLOGY</b>		
No.ofCredits	<b>Credits–2</b>	No.ofcontacthoursper week	4
NewCourse/ Revised Course	NewCourse	If revised, Percentage ofrevisioneffected(Minimu m 20%)	20
Category	ValueaddedCourse		
Scope of theCourse (maybemoret hanone)	1. Understandthe conceptsbiofertilizersandMushroomproduction 2. UtilizethevariousmethodologiesofbiofertilizersandMushroomforincomegener ation. 3. Comprehendtheinformationonthetechniquesandmotivatethestudentstobecom eEntrepreneur and Industrialists		
CognitiveLe velsaddresse dbythe Course	K1- Inculcate the advancement of biofertilizers and Mushroom productionK2-realize the various techniques involved in biofertilizers and Mushroomcultivation K3-Applytheknowledgeon varioustechniquesinIndustriallevel K4-Understandtheproblemsand factsofbiofertilizersandMushroomcultivation K5-Motivatethepeople to becomebiofertilizers andMushroomcultivation EntrepreneurandIndustrialists		
CourseObjecti ves(Maximum :5)	<b>TheCourseaims</b> • ToevaluateKnowledge andtechniquesofBiofertilizers • TounderstandthevariousprocessingTechnologiesof Azollacultivation • Toevaluatetheprocess ofinformationaboutmushroombiology: • Tovalidatetheimportanceof tropicalmushroom cultivationtechnology • ToidentifyNutrient profileofMushrooms		
Unit	Content	No.of Hours	
<b>I</b>	<b>Biofertilizers</b> Introduction, scope. A general account of plant growth promotersand regulators – Cyanobacterial Biofertilizer: Algalization – masscultivation of cyanobacterial biofertilizers. Nitrogen fixing Bacteria:Isolation,characterization,identification,masscultivationandi noculationmethodof <i>Rhizobium</i> and <i>Azospirillum</i> .Mechanismof nitrogenfixation(free-livingandsymbiotic)	12	
<b>II</b>	<b>Azollacultivation</b> StructureandMorphology– MasscultivationmethodandApplication.EconomicandEcologicalimp ortanceofAzolla.PhosphatesolubilizingBacteria:Isolation,characteriz ation,identification, mass cultivation and inoculation method of Phosphobacteria.Mycorrhizalfungiasbiofertilizers-Introduction,	15	

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	scope.AgeneralaccountofEcto,EndoandArbuscularmycorrhizae (AM). Isolation and method of inoculation of Arbuscularmycorrhizae(AM), Legume-AM interactions.	
<b>III</b>	<b>Introductiontomushroombiology:</b> characteristics,importanceofmushrooms- asfood,tonicsandmedicines.Differentpartsofatypicalmushroom.Keyt odifferentiateediblefrompoisonousmushrooms.phasesofmushroomte chnology-pureculture,spawn,preparationofcompost,mushroom development	10
<b>IV</b>	<b>Prospectsoftropicalmushroom cultivationtechnology:</b> Oystermushroomtechnology,paddymushroomtechnology,milkymush room and button mushroom technology, postharvest technology.Mushroomfarmingandprospects.	14
<b>V</b>	<b>Nutrientprofileof Mushrooms;</b> Protein, aminoacids, calorific values, carbohydrates , fats, vitamins&minerals. In therapeutic diets for adolescence, for aged persons &diabetesmellitus.Healthbenefits:Antiviralvalue,antibacterialeffect, antifungal effect, anti-tumour effect, haematological value,cardiovascularandrenal effect.	13
<b>References</b>	<b>ReferenceBooks</b> 1. Kannaiyan,S.,Kumar,K.andGovindarajan,K.,2010.Biofertilizers Technology. ScientificPublishers. 2. Kumar,R.,Kumawat,N.andSahu,Y.K.,2017.Roleofbiofertilizersi n agriculture. Popularkheti, 5(4), pp.63-66. 3. Rao,N.S.,1982.Biofertilizers.Interdisciplinarysciencereviews,7(3) ,pp.220-229. 4. Verma,A.(1999).Mycorrhiza.SpringerVerlag,Berlin. 5. Subba Rao, N.S. (1982). Advances in Agricultural Microbiology.Oxford&IBH Publishing Co.Pvt. Ltd., New Delhi. 6. NiirBoard,2004.TheCompleteTechnologyBookOnBioFertilizera ndOrganicFarming,NationalInstituteOfIndustrialResearch,Delhi. 7. Reddy,G.C.,Goyal,R.K.,Puranik,S.,Waghmar,V.,Vikram, K.V.andSruthy,K.S.,2020.Biofertilizerstowardsustainableagricultur aldevelopment.Plantmicrobesymbiosis.Springer,Cham,pp.115-128. 8. Dudeja, S.S., Singh, N.P., Sharma, P., Gupta, S.C., Chandra, R.,Dhar,B.,Bansal,R.K.,Brahmaprakash,G.P.,Potdukhe,S.R.,Gunda ppagol,R.C.andGaikawad,B.G.,2011.Biofertilizertechnologyandpul seproduction.InBioaugmentation,biostimulationandbiocontrol(pp.43 -63).Springer,Berlin, Heidelberg.	

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	<p>9. <a href="https://www.biologydiscussion.com/essay/bio-fertilizers-types-and-importance-of-bio-fertilizers/1901">https://www.biologydiscussion.com/essay/bio-fertilizers-types-and-importance-of-bio-fertilizers/1901</a></p> <p>10. Tripathi,D.P.(2005).MushroomCultivation.Oxford&amp;IBHPublishingCo.Pvt. Ltd.,New Delhi.</p> <p>11. PhilipG.Miles,Shu-TingChang,1997.Mushroombiology, WorldScientific, Singapore.</p> <p>12. Kaul,T.N.1999.Introductiontomushroomscience,Oxford&amp;IBHCo., Pvt. Ltd., NewDelhi.</p> <p>13. Bahl,N. 1988. Handbookonmushrooms.Oxford&amp;IBHPublishingCo.,Pvt. Ltd.,NewDelhi.</p>	
CourseOutcomes	<p>On completion of the course, students should be able to</p> <p>CO1:evaluate Knowledge and techniquesof Biofertilizers</p> <p>CO2:understandthe variousprocessingTechnologies ofAzollacultivation</p> <p>CO3: evaluate the process of information aboutmushroombiology:CO4:validate theimportanceoftropicalmushroomcultivationtechnology</p> <p>CO5:identify NutrientprofileofMushrooms</p>	

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
	2	3	3	3	

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