Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G.)

Scheme and Syllabus

Of

M. Sc. (Botany)(Final))(3rd and 4th sem.)

Program Code: MSCBOTR 101

Semester system for affiliated college

(As per LOCF and credit system)

W.E.F- 2024-2025

(As approved AC and EC meeting held on 16.08.2023 and 18.04.2023 respectively)

अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009

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Scheme of M.Sc. Botany under Semester System
Program Code: MSCBOTR101

Semester	Course Code	Subject Name	Credit			Total Credit	Marks			
							ESE	IA	Total	
			L	T	P				Max	Min
Third	BOTT301	Plant Physiology	3	1	-	4	80	20	100	36
	BOTT302	Plant Biochemistry and Bioenergetics	3	1	-	4	80	20	100	36
	BOTT303	Analytical Techniques and Biostatistics	3	1	-	4	80	20	100	36
	BOTT304	Elective-I: Plant Pathology - 1A	3	1	-	4	80	20	100	36
	BOTT304	Elective-II: Ethnobotany – 1B								
	BOTP301	Lab 1: Based on Paper BOTT301 and BOTT302	-	-	2	2	-	-	100	36
	BOTP302	Lab 2: Based on Paper BOTT303 and BOTT304	-	-	2	2	-	-	100	36
		Total	**12**	**4**	**4**	**20**	**-**	**-**	**600**	
Fourth	BOTT401	Plant Cell, Tissue and Organ Culture and Biofertilizers	3	1	-	4	80	20	100	36
	BOTT402	Plant Ecology and Environmental Issues	3	1	-	4	80	20	100	36
	BOTT403	Genetic Engineering of Plants and Microbes	3	1	-	4	80	20	100	36
	BOTT404	Elective-I: Plant Pathology - 2A	3	1	-	4	80	20	100	36
	BOTT404	Elective-II: Ethnobotany – 2B								
	BOTP401	Lab 1: Based on Paper BOTT401 and BOTT402	-	-	2	2	-	-	100	36
	BOTP402	Lab 2: Based on Paper BOTT403 and BOTT404	-	-	2	2	-	-	100	36
		Total	**12**	**4**	**4**	**20**	**-**	**-**	600	-

Note: *Students have to opt one paper from the pool of either Elective- 1A or 1B from 3rd Semester.*

ESE: End Semester Exam **IA: Internal Assessment**

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT301**		
2	Course Title	**Plant Physiology**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • After completion of the course the students are familiar with various physiological aspects involved in the plant development. • Qualitative and quantification of the plant contents and its biochemistry and mode /mechanism of synthesis etc. • Understand to mechanism of photosynthesis, respiration, nitrogen and lipid metabolism. • Understand to mechanism flowering process in plants. • Describe vernalization technique and applied in local crop plants.		
6	**Credit Value**	4		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Plant- Water relations:** Water potential, Diffusion, Osmosis, Plasmolysis; Membrane Transport and Translocation of Water and Solute; mechanism of water transport through xylem, root microbe interaction in facilitating nutrient uptake, comparison of xylem and phloem transport, phloem loading and unloading, active and passive solute transport. Transpiration, opening and closing of stomata and their regulation.	12
II	**Nitrogen and Sulphur Metabolism:** Overview biological nitrogen fixation, root nodules formation, mechanism of nitrate uptake and reduction, ammonium assimilation, sulphate uptake transport and assimilation. **Signal Transduction:** Overview, receptors and G-protein, phospholipids signaling, role of cyclin nucleotides calcium calmodulin cascade diversity in protein kinesis and phosphatases, specific signaling mechanism.	12
III	**Photochemistry and Photosynthesis:** General concept and historical background, photosynthetic apparatus, photosynthetic pigment and light harvesting complexes, photo-oxidation of water mechanism of electron and proton transport carbon assimilation the Calvin cycle, Photorespiration and its signification the C4 cycle CAM pathway, Factors affecting Photosynthesis.	12
IV	**Respiration:** Overview of aerobic and anaerobic respiration, glycolysis, TCA cycle, electron transport and ATP synthesis, pentose Phosphate pathway, glyoxylate cycle, alternative oxidase system. Factors affecting respiration.	12
V	**The Flowering Process:** Photoperiodism and its significance, endogenous clock and its regulation, photochrome, floral induction and development genetic and molecular analysis, role of vernalization. **Stress Physiology:** plant response to biotic and abiotic stress, mechanism of biotic and abiotic stress tolerance, HR and SAR water deficit and drought resistance salinity stress, metal toxicity, freezing, heat stress, oxidative stress.	12

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Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Galston, A. W., (1989) Life Processes in Plants, Scientific American Library. Springer-Verlag, New York, USA.
2. Hopkins, W. G., (1995) Introduction to Plant Physiology, John Willey and Sons, Inc. New York, USA.
3. Taiz, L. and Zeiger, E. (1998) Plant Physiology. Sinaver Associations, Inc. Pub., Masssachusetts, USA.
4. Moore, T. C.1974. Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.
5. Mc Donald M 2003 Photobiology of higher Plants, Jhon Wileys
6. Wadte, S. S. and Baiy M. M. V. (2004). Plant Physiology Laboratory guide, SSBES Yeshwant Mahavidyalaya Nanded.
7. Jain, 2000: Fundamentals of Plant Physiology, S. Chand, New Delhi.

Reference Books:

1. Chauhan, N. 2016: Development in Physiology, Biochemistry and Molecular Biology of Plants. Bio Green Books, New Delhi.
2. Roberts, J. and Tucker, G. A 2000. Plant Hormone Protocols. Humana Press, New Jersey, USA.
3. Salisbury, F.B. and Ross, C. W., (1992) Plant Physiology. Wadsworth Publishing Co., California, USA.
4. Denis, D. T., Turpin, D. H. Lefebvre, D. D. & Layzell, D. B. (1997) Plant Metabolism. Longaman, Essex, England.

E-Resources:

1. http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2TnI6UXl4VU9YT3BMQlQ3TG5iKy8wUVJaYzNHdWNvYURRaGpzY3doMVlONExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ
2. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
3. https://vidyamitra.inflibnet.ac.in/index.php/search
4. http://www.rarebookroom.org/
5. https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Botany_Plants_Science
6. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
7. Transpiration- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
8. Transport of Photo assimilates - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
9. Photoperiodism - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
10. Stress High Temp. - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
11. Salinity Stress - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
12. Vernalization - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
13. Glycolysis - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
14. Citric acid Cycle https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==

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Sl. No.	Category	Name of Nominated Members	Signature
1.	Chairperson	Prof. Sudhir Kumar Tiwari	
2.	Members	Smt. Shubha Verma	
		Dr. K. P. Namdeo	
		Shree T. P. Chandra	
		Dr. Sandeep Shukla	
		Smt. Indu Kaushal	
3.	VC Nominated members	Prof. Divya Bagachi	
		Prof. T. C. Bhalla	
4.	Corporate / Industrial Area Representatives		

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT302**		
2	Course Title	**Plant Biochemistry and Bioenergetics**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand structure and function of lipids. • know about energy flow and structure and function of ATP. • Enrich themselves with the phenomenon of metabolism of secondary metabolites and their role in plants. • understand to role of enzymes and plant growth regulators. • Understand to phenomena photobiology		
6	**Credit Value**	**4**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Energy Flow:** Principles of thermodynamics, free energy and chemical potential, redox reaction structure and function of ATP. **Structure and function of lipids:** fatty acid biosynthesis synthesis of membrane lipids, structural lipid and Storage lipids and their catabolism.	12
II	**Fundamentals of Enzymology:** General aspect, allosteric, mechanism, regulatory and active sites, isoenzymes, kinetics of enzymatic catalysis, Michaelis-Manton equation and its significance.	12
III	**Plant Growth Regulators and Elicitors:** Physiological effects and mechanism of auxins, gibberellins, ethylene, abscisic acid, polyamines and salicylic acid, hormone receptors.	12
IV	**Phytochemistry (Secondary metabolites)**: Alkaloids, Flavonoids, Tannins, Volatile Oils, Resins, Quinines and Steroids. Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.	12
V	**Sensory Photobiology:** History and discovery of phytochromes and cryptochromes, photochemical and biological property, photo physiology of light induced responses cellular localization, molecular mechanism of action of photo-morphogenic receptors.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. David, Nelson, L., Michael M. Lehninger principles of Biochemistry (2011) fourth Edition, Cox Publisher.
2. Farrell, O., Ryan T. Ranallo, Experiments in Biochemistry: A Hands on approach Publisher: Books Cole.
3. Garrett, R. H. and Grisham, C.M. (2010) Biochemistry: Publisher Book Cole.
4. Hopkins, W. G. (1995) Introduction to Plant Physiology John Willey and Sons, Inc. New York, USA.
5. Nobel, P. S. (1999) Physiochemical and Environmental Plant Physiology. Academic Press, San Diego, USA.
6. Chauhan, N. (2016). Development in Physiology, Biochemistry and Molecular Biology. Bio Green Book, New Delhi.
7. Sharma, S. (2016). Practical Manual of Biochemistry. Medtech

Reference Books:

8. Galaston, A. W., (1989) Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
9. Eric, E. Conn Paul. K. Stumpf, Geerge Brucning, Roy Doi (1987) Out lines of Biochemistry : Jhon Wiley USA.
10. Bucha, (2015). Biochemistry and Molecular Biology of Plants. JWO.
11. Moore, T. C. (1989) Biochemistry and Physiology of Plant Hormone. Springer Verlog, New York.
12. Jain, J. L. *et al.* (2022) Fundamental of Biochemistry, S. Chand Publication
13. Roberts, J. and Tucker, G. A 2000, Plant Hormone Protocols. Humana Press, New Jersey, USA.
14. Denis, D. T., Turpin, D. H. Lefebvre, D. D. & Layzell, D. B. (1997) Plant Metabolism. Longaman, Essex, England.

E-Resources:

1. **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
2. **http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YT3BMQlQ3TG5iKy8wUVJaYzNHdWNvYURRaGpzY3doMVlONExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ**
3. **https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering**
4. **https://vidyamitra.inflibnet.ac.in/index.php/search**
5. **http://www.rarebookroom.org/**
6. **https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Botany_Plants_Science**
7. **Catabolism of Lipid-** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
8. **Lipid Oxidation -** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
9. **Enzyme Nomenclature -** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
10. **Enzyme Structure -** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
11. **Cytokinin** - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
12. **Auxin- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==**

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1.	Chairperson	Prof. Sudhir Kumar Tiwari	
2.	Members	Smt. Shubha Verma	
		Dr. K. P. Namdeo	
		Shree T. P. Chandra	
		Dr. Sandeep Shukla	
		Smt. Indu Kaushal	
3.	VC Nominated members	Prof. Divya Bagachi	
		Prof. T. C. Bhalla	
4.	Corporate / Industrial Area Representatives		

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTP301**		
2	Course Type	**Practical Paper**		
3	Pre-requisite (If any)	**NIL**		
4	**Credit Value**	**2**		
5	**Total Marks**	**External Marks: 100**	**Min Passing Marks:36**	

Part B

Total No. of Hours: 30

Based on Paper	SUGGESTED LABORATORY WORK / FIELD EXERCISES	No. of Hrs.
BOTT301	• Determination of osmotic pressure of cell sap by plasmolytic method. • Determination of Diffusion pressure deficit in potato tuber. • To compare the rate of imbibition of fatty and starchy seeds. • Determination of osmotic pressure of cell sap by plasmolytic method. • Determination of effect of temperature on the permeability of plasma membrane of beet root. • Determination of effect of different organic solvents (alcohol, formalin, benzene) on the permeability of plasma membrane of beet root. • Determination of effect of different Phytohormones on the germination of seeds. • Determination of effect of different concentration of auxins on the germination of seeds. • Determination of the RQ by Ganong's Respirometer of different substrate. • Separation of chlorophyll pigments by paper chromatography. • Qualitative analysis of amino acids by paper chromatography. • Separation of chlorophyll by thin layer chromatography. • Determination of the effect of CO2 concentration on the rate of photosynthesis by inverted funnel method. • Determination of the effect of CO2 concentration on the rate of photosynthesis by Wilmot's bubbler. • Determination of the effect of intensity of light on the rate of photosynthesis by Wilmot's bubbler. • Determination of the effect of quality of light on the rate of photosynthesis by Wilmot's bubbler. •	15
BOTT302	• Qualitative estimation of amylase enzyme activity in the germinating seeds of wheat. • Qualitative estimation of catalase enzyme activity in the germinating seeds of wheat. • Effect of enzyme concentration on the rate of catalase enzyme activity in potato tuber. • Effect of enzyme concentration on the rate of amylase enzyme activity in of potato tuber. • Biochemical test of Secondary metabolites- Alkaloids, Flavonoids, Tannins, Resins, Quinines and Steroids.	15

Note: This is a tentative list of experiment, Teacher may add experiments according to their resources.

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT303**		
2	Course Title	**Analytical Techniques and Biostatistics**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
		At the end of this course, the students will be able to:		
5	Course Learning. Outcomes (CLO)	• Understanding of basic statistical methods to solve problems. • Develop the ability to apply the methods while working on a research project. • To develop critical thinking for interpreting analytical data. • Understand to detection and measurements of different types of radioisotopes. • Learn about light microscopy.		
6	**Credit Value**	**4**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Analytical Techniques and Instrumentation:** Principle and application of NMR, and ESR spectroscopy. Different types of mass spectrometry. Principle and application of different types of electrophoresis and chromatography, Isoelectric focusing gels. Isolation and purification of proteins by using different separation methods,	12
II	**Microscopic Techniques:** Principle and application of light microscope, Types of microscopes, resolving powers of different microscopes, scanning and transmission microscopes, different fixation and staining techniques.	12
III	**Radiolabeling Techniques:** History and concept of Radiolabel in biology, Isotopes-definition, Types, chemical properties and importance, Tools and techniques for detection of radioactive isotopes normally used in biology, molecular imaging of radioactive material, safety guidelines in handling radioactive elements.	12
IV	**Biostatistics:** Definition and importance of Biostatistics scope, Measurement of central tendencies -mean, mode and median. Standard deviation, probability distributions, sampling distribution, Standard errors, levels of significance, t-test, x^2 test.	12
V	**Basics of computer:** Generations of computer, Hardware and Software, RAM and ROM, Operating System, Internet, Search Engine, Printer & Scanner, Keyboard, Mouse, Monitor, Paint tools.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Braun, R. (1988) Introduction to instrumental analysis, J. Chem. Educ., 65 (12), pp A336.
2. Clark, J. M. and Swizer R. L. (2000) Experimental Biochemistry, 3rd edition, W. H. Freeman & Co Ltd.
3. Locquin, M. and Langeron M. (1983) Handbook of Microscopy, Butterwaths – Heinemann.
4. Wilson, K. and Goulding K. H. (1986) A biologist Guide to principles and Techniques of Practical Biochemistry London.
5. Wilson, K. and Walker J. (2000) Practical Biochemistry, 5th edition, Cambridge University Press.
6. Singh and Choudhary (1985) Biometrical Methods in Quantitative Genetic Analysis, Kalyani Publisher, New Delhi.
7. Sharma, A. K, Text book of Biostatistics, Discovery Publishing House Pvt. Ltd.
8. Manjunath, G. (2010), Computer Basics, Vasan Publications.
9. Sinha, P. and Sinha, Pradeep K., (2004), Computer Fundamentals, BPB Publications.

Reference Books:

1. Cooper, G. M. (1997) The Cell-A Molecular Approach. ASM press.
2. Freifelder, D. M. (1982) Physical Biochemistry, W. H. Freeman and Co.
3. Boyer, R. F. (1993) Modern Experimental Biochemistry, 2nd edition, Benjamin Cummings.

E-Resources:

1. **https://ihas.its.edu.in/Home/E-Resources-for-Biotechnology.aspx**
2. **Electrophoresis Basics-** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
3. **UV Vis Spectrophotometry -** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
4. **Mass Spectrometry -** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
5. **Gel Electrophoresis -** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
6. **SEM-** https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==
7. **Biostatistics https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
8. **Measures of central Tendency-** **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
9. **Statistical Test - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
10. Basics of Computer: https://edu.gcfglobal.org/en/computerbasics/what-is-a-computer/1/

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		Dr. K. P. Namdeo	
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		Smt. Indu Kaushal	
3.	VC Nominated members	Prof. Divya Bagachi	
		Prof. T. C. Bhalla	
4.	Corporate / Industrial Area Representatives		

Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT304 (Elective- I)**		
2	Course Title	**Plant Pathology – 1A**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the interaction between plant and pathogen in relation to the overall environment. • Demonstrate an understanding of the principles of plant pathology and the application of these principles for the control of plant disease. • Understanding nature and concept of disease in plants and their effect on human affairs. • Learn about pathogenicity • Understand causes of plant diseases and mode of infection. • Learn about seed quality standards, seed certification and export and import of seeds.		
6	**Credit Value**	**4**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**General Introduction:** Nature and Concept of diseases in plant, importance of plant diseases and their effect on human affairs, definition and terms in plant pathology, history and development of plant pathology, contribution of plant pathology in India and aboard.	12
II	**Plant Diseases:** Symptomatology of parasitic and non-parasitic diseases, classification of plant diseases. **Methods of studying Plant Diseases:** Airborne, soil borne and seed borne diseases	12
III	**General Characteristics:** Fungi, bacteria and viruses, with emphasis on parasitism, parasitic ability and virulence. **Pathogenicity:** Distribution on plant pathogens, mode of infection, inoculums and inoculums potential, Koch's postulates.	12
IV	**Host Parasite Relation:** Parturition of infection, role of enzyme and toxicity pathogenesis, defense of plant against pathogens, resistance and susceptibility by Para sensitive reaction phytoalexins diseases syndrome.	12
V	**Seed certification and quality control:** Importance; Seed quality standards - definition and . concept. purpose and phases of seed certification; tolerance levels; Seeds Act and . Seeds rules and law enforcement; Seed inspection procedures and equipment.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Agrios, G. N. (1997) Plant Pathology, Academic Press, London.
2. Bilgrami, K. S. and Dubey, H. C. (1985) Plant Pathology, Vikas Publ. House, Sahibabad U.P.
3. Ali, S. S. and Kulshereshta, P. (1986) plant pathology, Adeeb educational, Raipur.
4. Singh, R. S. (1980) Plant Pathology, Oxford IBH Publ. Co, New Delhi.
5. Plant Pathology - Sharma, P. D. Vivek Rastogi for Rastogi & Co., Meerut. 1995.
6. Mehrotra, R. S. & Aggarwal, A. (2013) Fundamentals of Plant Pathology, Tata McGraw Hill Education Private Limited

Reference Books:

1. Bridges, P. (1998) Molecular Variability of Fungal Pathogens. CAB
2. John A. Lucas (2020) Plant Pathology and Plant Pathogens 4th Edition, Wiley-Blackwell
3. Rangaswami, M. (1998) Discases of Crop Plants in India, PHI
4. Schumann, Gail L.& J. D'Arcy Cleora (2009) Essential Plant Pathology, Second Edition, American Phytopathological Society

E-Resources:

1. http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YT3BMQlQ3TG5iKy8wUVJaYzNHdWNvYURRaGpzY3doMVlONExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ
2. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
3. https://vidyamitra.inflibnet.ac.in/index.php/search
4. http://www.rarebookroom.org/
5. https://ihas.its.edu.in/Home/E-Resources-for-Biotechnology.aspx
6. **Plant pathology** - https://www.biologydiscussion.com/plant-pathology/biology-notes-on-plant-pathology/46320
7. **Plant disease** - https://www.biologydiscussion.com/plants/plant-diseases/plant-diseases-with-diagram-botany/63990
8. **Host Parasite Relation** - https://www.biologydiscussion.com/animals-2/aschelminthes/interactions-between-host-and-parasite/32918
9. **Fungi** - https://www.biologydiscussion.com/fungi/fungi-meaning-characteristics-and-occurrence-botany/46481
10. **Bacteria** - https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-01.pdf
11. https://www.inspiritvr.com/general-bio/prokaryotes-and-viruses/bacteria-structure-and-classification-study-guide
12. **Viruses** - https://www.inspiritvr.com/general-bio/prokaryotes-and-viruses/viruses-structure-and-classification-study-guide
13. https://www.biologydiscussion.com/viruses/viruses-meaning-nature-and-structure/34302

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1.	Chairperson	Prof. Sudhir Kumar Tiwari	
2.	Members	Smt. Shubha Verma	
		Dr. K. P. Namdeo	
		Shree T. P. Chandra	
		Dr. Sandeep Shukla	
		Smt. Indu Kaushal	
3.	VC Nominated members	Prof. Divya Bagachi	
		Prof. T. C. Bhalla	
4.	Corporate / Industrial Area Representatives		

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(15)

Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT304 (Elective- II)**		
2	Course Title	**Ethnobotany – 1B**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
		At the end of this course, the students will be able to:		
5	Course Learning. Outcomes (CLO)	• Explore ethnobotanical knowledge of plants through traditional indigenous approaches. • Explain about concept, scope and objectives of ethnobotany. • Learn about general ethnobotanical techniques. • Understand importance of medicinal plants. • Understand about cultural significance of plants.		
6	**Credit Value**	4		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Ethnobotany general account - I:** Introduction, concept, scope and objectives. Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. Major and minor ethnic groups or tribals of Chhattisgarh and their life styles. (Gond and Baiga)	12
II	**Ethnobotany general account - II:** Role of ethnobotany in primary health care Programs, Ethnobotany in India retrospect's & prospects in India Plants used by the tribals- a) Food plants b) Intoxicants and beverages c) Resins, oils and miscellaneous uses d) Sacred plants	12
III	**Methods in the ethnobotanical study:** Quantitative approach (Open-ended and semi-structured interviews, 'Hands on' learning of traditional techniques) and Qualitative approach (Structured interviews and questionnaires, Free-listing, Pile sorting and preference ranking: triadic and paired, Systematic surveys -e.g., of transects or hectare plots); Quantification and verification: Free-listing, Preference ranking. Direct matrix ranking. Utilization surveys. Interview techniques and elicitation methods: Choosing participants. Linguistic and other symbolic analyses - Symbolic and Empirical analysis of Myths and Folklore.	12
IV	**Ethnobotanical study of following plants with special reference to their medicinal importance:** (a) *Azadirachta indica* (Neem) (b) *Emblica officinalis* (Amla) (c) *Ricinus communis* (Andi) (d) *Madhuca indica* (Mahua) (e) *Cassia fistula* (Amaltash) (f) *Ficus religiosa* (pipal) (g) *Oscimum sanctum* (Tulsi) (h)*Asparagus recemosus* (Satavar) (i) *Aloe vera* (Ghritkumari) (j) *Andrographis paniculata* (Bhuineem)	12
V	**Ethnobotany on Development and Conservation, on bio resources.** **Methodology of ethnobotanical studies:** (a) Field work (b) Herbarium (c) Ancient Literature (d) Archaeological findings (e) Temples and sacred places.	12

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Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Jain, S. K. (1993) Manual of Ethnobotany, Scientific Publisher, Jodhpur.
2. Jain, S. K.(ed) (1989) methods and approaches in ethnobotany, Society of ethnobotanists, Lukhnow, India
3. Sinha, Rajiv K. (1996) Ethnobotany The Renaissance of Traditional Herbal Medicine – INA Shree Publisher, Jaipur.
4. Sivarajan, V. V. and Indira, Balachandran (1994) Ayurvedic drugs and their plant source, Oxford IBH pub. Co.
5. Anne Green (2000) Principles of Ayurveda, Thomsons,
6. Kokate *et al.,* (1999) Pharmacognosy, Nirnil Prakashan

Reference Books:

1. Jain, S. K. (1990) Contribution of Indian Ethnobotany, Scientific Publisher, Jodhpur.
2. Colton, C. M. (1997) Ethnobotany – Principles and applications, John Wiley and Sons – Chichester
3. Rao, R. N. and Henry, A. N. (1996). The Ethnobotany of Estern Ghats in A.P., India . Bot survey of India, Howrah.
4. Kochhar, S. L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition
5. Singh, Sadhana, Economic Botany of Angiosperms 2015, Biogreen Books, New Delhi.
6. Saxena, Rupali, (2015). Economic Botany of Angiosperms, Biogreen Books, New Delhi.

E-Resources:

1. **https://sarahtuckercollege.edu.in/e-resources/6/botany**
2. **https://sarahtuckercollege.edu.in/e-resources/6/botany**
3. **Ethnobotany- https://www.biologydiscussion.com/botany/ethno-botany-definitions-development-and-importance/7158**
4. **Food Plants- https://www.biologydiscussion.com/india/5-main-groups-of-food-plants-in-india/52876**

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		Dr. Sandeep Shukla	
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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: III**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTP302**		
2	Course Type	**Practical Paper**		
3	Pre-requisite (If any)	**NIL**		
4	**Credit Value**	**2**		
5	**Total Marks**	**External Marks: 100**	**Min Passing Marks:36**	

Part B

Total No. of Hours: 30

Based on Paper	SUGGESTED LABORATORY WORK / FIELD EXERCISES		No. of Hrs.
BOTT303	• Isolation of DNA and its quantification by UV- spectrophotometric method. • Isolation of RNA and its quantification by UV- spectrophotometric method. • Detection of DNA by Agarose gel electrophoresis. • To calculate mean, variance, standard deviation, standard error, coefficient of variations and to use t test for comparing two means related to data. • Computer based experiments.		15
BOTT304	**Elective – I (Plant Pathology – 1A)**	• Collection and preservation of diseased plants parts through field visit. • Study of stages for the demonstration of Koch's postulate for identification of pathogenicity of an organism. • Study of fungal diseases of important crop and vegetable plants. • Study of symptoms and host parasite interactions through field visit/museum specimens/photographs. • Symptomatological study of important Bacterial /viral/ Mycoplasmal diseases of economically important plants. • Special features of some plant pathogens through slide preparation/permanent slide. Plants Pathological Methods. • Isolation of fungal pathogens/microorganisms from leaves • Isolation of fungal pathogens/microorganisms from rhizosphere • Isolation of fungal pathogens/microorganisms from air by exposure plant techniques.	15
	OR		
	Elective – II (Ethnobotany-1B)	• Description and identification of medicinal plants and its medicinal properties • Preparation of medicinal plants herbarium and photograph o Herbal preparation — a. Extract of Tulsi leaves. b. Ointment from *Cassia alata* leaves c. Ayurvedic Tooth powder d. Amla Churna e. Face pack preparation from various herbs • To cultivate at least 2 medicinal plants in earthen pots.	

Note: This is a tentative list of experiment, Teacher may add experiments according to their resources.

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT401**		
2	Course Title	**Plant Cell, Tissue and Organ Culture and Biofertilizers**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Define the basic concepts of plant tissue culture. • Understand the basic properties of plant cell and with apply their basic knowledge of Plant Tissue Culture in various fields for conservation, medicine, product development etc. • Recognize the various steps taken to establish and optimize media for particular purpose in particular species. • Know about role of microbes and plants as biofertilizer. • Prepare bio-compost and applied in the field.		
6	**Credit Value**	**4**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Biotechnology:** Basic concept, principal, scope and application. **Plant Tissue Culture:** General introduction, history, scope and techniques, concept of cellular differentiation, totipotency, Laboratory establishment.	12
II	**Organogenesis and Adventive Embryogenesis:** Fundamental aspects morphogenesis somatic embryogenesis and androgenizes. **Somatic Hybridization:** Protoplast isolation fusion and culture, hybrid & Cybrid selection and regeneration, possibilities achievements and limitations of protoplast Culture.	12
III	**Application of Plant Tissue Culture:** Clonal propagation, Micropropagation, production of hybrids and soma clones and production of secondary metabolites /natural products, cryopreservation and germ plasma storage. Role of tissue culture in production of pathogen - free plants and synthetic seeds.	12
IV	**Biofertilizer I:** General account about the microbes and plants used as biofertilizer, Isolation, identification, mass multiplication, carrier- based inoculants of *Azospirillum, Rhizobium* and *Azotobacter.* Blue green algae and Azolla in rice cultivation.	12
V	**Biofertilizer II:** Mycorrhizal association, types of mycorrhizal association, Organic farming –Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes, Bio-compost making methods, types and field Application.	12

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Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Bhojwani, S. S and Razdan, N.K. (1996) Plant Tissue Culture: Theory and Practice, Elsevier Science Publishers, New York, USA.
2. Vasil, I. K. and Thorbe, T. A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, Netherlands.
3. Smith, R. H. (2000) Plant Tissue Culture; Techniques and Experiments, Academic Press, New York.
4. Rai, M. K. (2006) Handbook of Microbial Biofertilizers, International Book Distributing Co.
5. Beier, Wilhelm(2020) Handbook Microbial Biofertilizers, White Press Academic

Reference Books:

6. Subbarao, N. S. (2017) Bio-fertilizers in Agriculture and Forestry, Medtech
7. Collins, H.A. and Edwards, S. (1998) Plant Cell Culture, Bios. Scientific Publisher, Oxford, U.K.
8. Kartha, K.K. (1985) Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida, USA.

E-Resources:

1. **https://ihas.its.edu.in/Home/E-Resources-for-Biotechnology.aspx**
2. **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
3. **http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YT3BMQlQ3TG5iKy8wUVJaYzNHdWNvYURRaGpzY3doMVlONExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ**
4. **https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering**
5. **https://vidyamitra.inflibnet.ac.in/index.php/search**
6. **http://www.rarebookroom.org/**
7. **https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Botany_Plants_Science**
8. **PTC History- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**
9. **Cell and Tissue Culture - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**
10. **Micropropagation- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**
11. **Somatic Hybridization - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**
12. **Organogenesis - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**
13. **Lab. For PTC - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**
14. **Somatic Embryogenesis - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==**

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT402**		
2	Course Title	**Plant Ecology and Environmental Issues**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the concept, types, development and functions of various ecosystems and their communication. • The various environmental factors governing these ecosystems are also clearly understood. • Understand the factors leading to Environmental degradation, their reasons and their impact on the environment. • Describe pollution problems and cause of pollution. • Know about climate change.		
6	**Credit Value**	4		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Ecology:** Concept, history and definition. **Ecological Factors:** Climatic -light, temperature, air and water topographic, edaphic, soil formation soil texture type of soil profile, biotic factor interrelationships. **Ecosystem Organization:** Structure and function, primary production (methods of measurements, global pattern, controlling factors), tropic organization, energy flow pathways, ecological efficiencies, global biochemical cycle of C. N. P. S. minerals cycle pathway processes budgets in terrestrial and aquatic ecosystems.	12
II	**Vegetation Organization:** life zone major biomes and vegetation of the world, concept of community, analytic and synthetic characters, concept of ecological niche, Ecotone & edge effect. **Origin of Intra- Population Variation:** Population & the environment, ecads & ecotypes, evolution & differentiation of species - various models. **Vegetation Development:** Mechanism of ecological succession.	12
III	**Air Water and Soil Pollution:** Kinds, source, quality parameters, effect on plant and ecosystem. **Climate Change:** Greenhouse gases (CO_2, CH_4, N_2O, CFCs) sources, trend and role, ozone layer and ozone hole consequences of climate changes-CO_2 fertilization, global warning, sea level rise UV radiation.	12
IV	**Ecological Stability:** Concept (resistance and resilience), ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystem, ecology of plant invasion, environmental impact assessment, ecosystem restoration **Ecological management:** Concepts, Sustainable development, Sustainability indicators.	12
V	**Concept of Phytogeography:** Major terrestrial biomes; biogeographical zones of India; theory of island biogeography. Endemism, hot spots and hottest hot spots, plant exploration, invasion &introduction, local plant diversity and its socio-economic importance.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Brady, N. C. (1990) The Nature and Properties of Soil Macmillan, Sydney, Australia.
2. Begon, M; Harper, J. L. And Townsend, C. R. (1996) Ecology. Blackwell Science, Cambridge, USA
3. Kumar, H. D. (1986) Modern Concept of Ecology, Vikas Publishing House Private Ltd., New Delhi.
4. Hill, M. K. (1997) Understanding Environmental Pollution. Cambridge Univ. Press, Cambridge, U. K.
5. Rangarajan, M. (2009) Environmental Issues in India, Pearson Education
6. Sharma, P. D. (2012) Ecology And Environment, Rastogi Publications

Reference Books:

1. Odum, E. P. (1971) Fundamentals of Ecology. Saunders, Phildelphhia.
2. Odum, E. P. (1983) Basic Ecology. Saunders, Philasephia.
3. Harris, F. (2005) Global Environmental Issues, Wiley
4. Chapman, J. L. and Raiss, M. J. (1988) Ecology: Principles and Applications. Cambridge Univ. Press, Cambridge, U.K.

E-Resources:

1. **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
2. **http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YT3BMQlQ3TG5iKy8wUVJaYzNHdWNvYURRaGpzY3doMVlQNExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ**
3. **https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering**
4. **https://vidyamitra.inflibnet.ac.in/index.php/search**
5. **http://www.rarebookroom.org/**
6. **https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Botany_Plants_Science**
7. **Environmental Pollution**
   - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
8. **Biogeographical Zones -**
   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
9. **Terrestrial Biomes -**
   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
10. **Global Environment Change –**
    https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
11. **Abiotic Components of Ecosystem –**
    https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
12. **Mechanism of Succession -**
    https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==

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Name and Signatures of Members of Board of Studies

Sl. No.	Category	Name of Nominated Members	Signature
1.	Chairperson	Prof. Sudhir Kumar Tiwari	
2.	Members	Smt. Shubha Verma	
		Dr. K. P. Namdeo	
		Shree T. P. Chandra	
		Dr. Sandeep Shukla	
		Smt. Indu Kaushal	
3.	VC Nominated members	Prof. Divya Bagachi	
		Prof. T. C. Bhalla	
4.	Corporate / Industrial Area Representatives		

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTP401**		
2	Course Type	**Practical Paper**		
3	Pre-requisite (If any)	**NIL**		
4	**Credit Value**	**2**		
5	**Total Marks**	**External Marks: 100**	**Min Passing Marks:36**	

Part B

Total No. of Hours: 30

Based on Paper	SUGGESTED LABORATORY WORK / FIELD EXERCISES	No. of Hrs.
BOTT401	• Isolation protoplast from various plant tissues and testing their viability. • Effect of physical (e.g. temperature) and chemical (e.g. osmoticum) factors on protoplast yield. • Media preparation and Sterilization of lab utensils and explant. • Demonstration of protoplast fusion employing PEG. • Organogenesis and somatic embryogenesis using appropriates explants and preparations of artificial seed	15
BOTT402	• To determine minimum size and number of quadrats required for reliable estimate of biomass in grassland. • To calculate density, abundance, frequency, basal area, relative density, relative frequency and relative dominance of the data. • To compare protected and unprotected grassland stands using community coefficients (similarity indices). • To estimate IVI of the species in a woodland using point centered quarter method. • To find out the relationship between two ecological variables using correlation and regression analysis. • To find out important grassland species using chi square test. • Scientific visits to a protected area, a wet land, a mangrove, NBPGR, BSI, CSIR, ICAR labs.	15

Note: This is a tentative list of experiment, Teacher may add experiments according to their resources.

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT403**		
2	Course Title	**Genetic Engineering of Plants and Microbes**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Basic principles and modern age applications of recombinant DNA technology. • Understand gene cloning and DNA fingerprinting. • Different methods used for genetic transformation of plants, use of Agrobacterium as a vector for plant transformation. • Understand fermentation technology. • Know about biological database.		
6	**Credit Value**	**4**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Recombinant DNA Technology:** Gene Cloning principle and techniques, Construction of genomic /cDNA libraries, choice of vectors, DNA synthesis and sequencing, polymerase chain reaction (PCR), DNA finger printing.	12
II	**Genetic Engineering of Plants:** Aims, strategies for development of transgenic (with suitable example), Agrobacterium- the nature genetic engineering, T-DNA and transposon mediated gene tagging, intellectual property rights, possible ecological risks and concerns. Transgenic plants for crop improvement.	12
III	**Microbial Genetic Manipulation:** Bacterial transformation, selection of recombinants and transformants. genetic improvement of industrial microbes and nitrogen fixer's, fermentation technology.	12
IV	**Genomics:** Genetic and physical mapping of genes, molecular markers for introgression of useful traits, artificial chromosome, DNA sequencing, genome projects, bioinformatics, Genome expression analysis, RNA content and profiling, RNAi and gene silencing, genome imprinting,	12
V	**Proteomics:** Introduction and Importance of proteomics, strategies in analysis of proteome: 2-D PAGE, Protein sequencing method. **Applied proteomics:** Databases and Search engines in proteomics, Post translational protein modifications, protein localization.	12

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Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Brown, T. A. (1999) Genomes. John Willey and Sons Asia Pvt. Ltd., Singapore.
2. Callow, J. A. Ford-Loyd, B. V. and Newbury, H. J. (1997) Biotechnology and Genetic Resources:

   Conservation and Use. Cab International, Oxon, UK.
3. Glazer, A. N. and Nikaido, H. (1995) Microbial Biotechnology. Freman and Company, New York, USA.
4. Hennery, R. J. (1997) Practical Applications of Plant Molecular Biology. Chapman and Hall, London UK.
5. Jolles, O. And Jornvali, H. (2000) Proteomics in Functional Genomics. Birkhauser Verlag, Basel,

   Switzerland.
6. Bhojwani, S. S and Razdan, N.K. (1996) Plant Tissue Culture: Theory and Practice, Elsevier Science Publishers, New York, USA.

Reference Books:

1. Primrose, S. B. (1995) Principles of Genome Analysis, Blackwell Scientific Publications, Oxford, UK.
2. Raghvan, V. (1997) Molecular Biology of Flowering Plants. Cambridge Univ. Press, New York, USA.
3. Old, R. W. Primerose, S. B. (1989) Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford UK.

E-Resources:

1. **https://ihas.its.edu.in/Home/E-Resources-for-Biotechnology.aspx**
2. **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==**
3. **http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YT3BMQlQ3TG5iKv8wUVJaYzNHdWNvYURRaGpzY3doMVlONExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ**
4. **https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering**
5. **https://vidyamitra.inflibnet.ac.in/index.php/search**
6. **http://www.rarebookroom.org/**
7. **https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Botany_Plants_Science**
8. **Agrobacterium-**

   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
9. **T- DNA - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==**
10. **Gene Transfer -**

    https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==
11. **IPR - https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==**
12. **Tools for GE.-**
    https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1p0OY7YTBClr5D2KEqnvVg==

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT404 (Elective- I)**		
2	Course Title	**Plant Pathology – 2A**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
		At the end of this course, the students will be able to:		
5	Course Learning. Outcomes (CLO)	• Understand symptomology and epidemiology. • Know about methods of studying plant diseases and their diagnosis. • Understand principles of plant disease control. • Know about disease in wheat, rice, bajra, maize, arhar, gram and pea caused by fungi, bacteria, virus, mycoplasma and nematodes. • Know about disease control.		
6	**Credit Value**	**4**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Effect of Environment on Disease Development:** Predisposition and stress epidemiology and disease forecasting, sources of infection i.e., seed- Soil, water and air born disease of plants, significance of phyllosphere and rhizosphere studies, recurrence of disease.	12
II	**Symptomology and Epidemiology:** Disease identification based on symptoms, (external and internal). **Epidemiology:** epiphytotic, disease forecasting. **Methods of Studying plant diseases and their diagnosis:** Field observation, collection of samples, culturing of pathogenic organisms (fungi, bacteria and mycoplasma), Koch's postulates.	12
III	**Control of Plant Disease:** Principles of plant disease control, method of control eg. regulatory, chemical, biological and breeding for disease resistant varieties of host, plant quarantine.	12
IV	**Disease Cycle I:** Crop loss estimate and recommended control for important plant disease caused by fungi, bacteria, viruses, mycoplasma and nematodes in the following crop plants- Wheat, Rice, Bajra, Maize Sugarcane. Arhar, Gram, Pea.	12
V	**Disease Cycle II:** Crop loss estimate and recommended control for important plant disease caused by fungi bacteria, viruses, mycoplasma and nematodes in the following crop plants- A) Groundnut, Till, Linseed, Cotton. B) Chilli, Tomato, Potato, Brinjal, coriander, Tobacco. Citrus fruit e.g. Lemon, Orange, Musambi, Papaya, Apple and Banana.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Agrios, G. N. (1997) Plant Pathology, Academic Press, London.
2. Bilgrami, K. S. and Dubey, H. C. (1985) Plant Pathology, Vikas Publ. House, Sahibabad U.P.
3. Ali, S. S. and Kulshereshta, P. (1986) plant pathology, Adeeb educational, Raipur.
4. Singh, R. S. (1980) Plant Pathology, Oxford IBH Publ. Co, New Delhi.
5. Plant Pathology - Sharma, P. D. Vivek Rastogi for Rastogi & Co., Meerut. 1995.
6. Mehrotra, R. S. & Aggarwal, A. (2013) Fundamentals of Plant Pathology, Tata McGraw Hill Education Private Limited

Reference Books:

1. Bridges, P. (1998) Molecular Variability of Fungal Pathogens. CAB
2. John A. Lucas (2020) Plant Pathology and Plant Pathogens 4th Edition, Wiley-Blackwell
3. Rangaswami, M. (1998) Diseases of Crop Plants in India, PHI
4. Schumann, Gail L.& J. D'Arcy Cleora (2009) Essential Plant Pathology, Second Edition, American Phytopathological Society

E-Resources:

1. **http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YT3BMQlQ3TG5iKy8wUVJaYzNHdWNvYURRaGpzY3doMVlONExBV3BxbE1GM0MzVVZUR1BxZVNHVlJ5bG9iMWpJcGc9PQ**
2. **https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering**
3. **https://vidyamitra.inflibnet.ac.in/index.php/search**
4. **http://www.rarebookroom.org/**
5. **https://ihas.its.edu.in/Home/E-Resources-for-Biotechnology.aspx**

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTT404 (Elective- II)**		
2	Course Title	**Ethnobotany – 2B**		
3	Course Type	**Theory Paper**		
4	Pre-requisite (If any)	**NIL**		
		At the end of this course, the students will be able to:		
5	Course Learning. Outcomes (CLO)	• Understand ethnobotanical importance of bacteria, algae Fungi, bryophytes, pteridophytes and gymnosperm. • Know about traditional systems of medicine. • Role of ethnobotany in modern medicine. • Know about in-situ and ex-situ conservation and documentation and analysis of ethnobotanical data. • Know about intellectual property rights		
6	**Credit Value**	4		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course Total No. of Hours: 60		
Unit	**Topics**	**No. of Hrs.**
I	**Traditional system of medicine**—Brief history of use of medicinal herbs, introduction to indigenous systems of medicine Ayurveda, Unani and Siddha system of medicine. Ethnobotany in relation to national priorities and health care programs.	12
II	**Ethnobotanical importance:** Ethnobotanical importance of Bacteria, Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. Ethnoveterinary - medicines from plants. Major and minor forest products of Chhattisgarh.	12
III	**Ethnobotany in relation** to livelihood security, Reference to tribes. Ethnobotanical research done in India. Intellectual Property Rights with particular reference to Traditional knowledge.	12
IV	**Role of ethnobotany** - in modern medicine, medico ethnobotanical sources in India, Significance of the following plants in ethnobotanical practices along with their habitat and morphology. (a) *Terminalia arjuna* (b) *Vitex- negundo* (c) *Pongamia pinnata* (d) *Cassia auriculata* (e) *Indigophera tinctoria*. Role of ethnobotany in modern medicine with special example of *Rauvolfia serpentina*, *Withania somnifera*, *Tinospora cordifolia*, *Vinca rosea*, *Moringa oleifera*.	12
V	**Traditional germplasm management:** *In-situ* and *Ex-situ* conservation; Local benefits: Cultural survival and community development: Ethnomedicine and Primary health care; **Renewable plant products:** Sustainable source of income; Protecting local resources. Commercialization and conservation: Sustainable development - Economic growth and resource conservation. Documentation and analysis of ethnobotanical data.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Jain, S. K. (1993) Manual of Ethnobotany, Scientific Publisher, Jodhpur.
2. Jain, S. K.(ed) (1989) methods and approaches in ethnobotany, Society of ethnobotanists, Lukhnow, India
3. Sinha, Rajiv K. (1996) Ethnobotany The Renaissance of Traditional Herbal Medicine – INA Shree Publisher, Jaipur.
4. Sivarajan, V. V. and Indira, Balachandran (1994) Ayurvedic drugs and their plant source, Oxford IBH pub. Co.
5. Anne Green (2000) Principles of Ayurveda, Thomsons,
6. Kokate *et al.,* (1999) Pharmacognosy, Nirnil Prakashan

Reference Books:

1. Jain, S. K. (1990) Contribution of Indian Ethnobotany, Scientific Publisher, Jodhpur.
2. Colton, C. M. (1997) Ethnobotany – Principles and applications, John Wiley and Sons – Chichester
3. Rao, R. N. and Henry, A. N. (1996). The Ethnobotany of Estern Ghats in A.P., India . Bot survey of India, Howrah.
4. Kochhar, S. L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition
5. Singh, Sadhana, Economic Botany of Angiosperms 2015, Biogreen Books, New Delhi.
6. Saxena, Rupali, (2015). Economic Botany of Angiosperms, Biogreen Books, New Delhi.

E-Resources:

1. **https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering**
2. **https://vidyamitra.inflibnet.ac.in/index.php/search**
3. **http://www.rarebookroom.org/**

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Part A: Introduction				
Program: M. Sc. (Botany)		**Semester: IV**	**Year: 2**	**w.e.f.: 2024-2025**
1	Course Code	**BOTP402**		
2	Course Type	**Practical Paper**		
3	Pre-requisite (If any)	**NIL**		
4	**Credit Value**	**2**		
5	**Total Marks**	**External Marks: 100**	**Min Passing Marks:36**	

Part B

Total No. of Hours: 30

Based on Paper	SUGGESTED LABORATORY WORK / FIELD EXERCISES		No. of Hrs.
BOTT403	• Growth characteristics of E. coli using plating and turbidimetric methods. • Isolation of plasmid from E. coli by alkaline lysis method and its quantitation spectrophotometrically. • Restrictiion digestion of the plasmid and estimation of the size of various DNA fragment. • Cloning of DNA fragment in a plasmid vector, transformation of the given bacteria population and selection of recombinants. Demonstration of DNA sequencing by Sanger's dideoxy method.		15
BOTT404	**Elective – I (Plant Pathology – 2A)**	• Collection and preservation of diseased plants parts through field visit. • Study of stages for the demonstration of Koch's postulate for identification of pathogenicity of an organism. • Study of fungal diseases of important crop and vegetable plants- Study of symptoms and host parasite interactions through field visit/museum specimens/photographs. • Symptomatological study of important Bacterial/viral/ Mycoplasmal diseases of economically important plants. • Special features of some plant pathogens through slide preparation/permanent slides. Plant Pathological Methods. • Isolation of fungal pathogens/microorganisms from leaves • Isolation of fungal pathogens/microorganisms from rhizosphere • Isolation of fungal pathogens/microorganisms from air by exposure plant techniques	15
	OR		
	Elective – II (Ethnobotany-2B)	Documentation techniques of Ethnobotanical knowledge Field Study of forest area or Tribal area. Herbal Preparation — a. Preparation of Triphala. b. Kwath of Triphala c. Preparation of powder for diabetes control. d. Preparation of herbal shampoo e. Giloy Chum To separate active principals from the extract of medicinal plants.	

Note: This is a tentative list of experiment, Teacher may add experiments according to their resources.

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