

ONE YEAR POSTGRADUATE PROGRAM (NEP-2020)

Program: Master in Botany (2025 -26)

Session: 2025 – 26

Course type	Course code	Course Title	Paper	Semester	Credits	Max. marks	Min. Marks	CIA	ESE
DSC	BOSC-09T	Research Methodology & Scientific Writing	T	III	4	100	40	30	70
DSC	BOSC-10T	ICT Tools in Research	T	III	4	100	40	30	70
DSE	BOSE-13T	Advance Techniques in Plant Science and Phytopathology	T	III	3	100	40	30	70
DSE	BOSE-14T	Applied Phytochemistry and Pharmacognosy	T	III	3	100	40	30	70
DSE	BOSE-15T	Forensic Botany & Agricultural Nanotechnology	T	III	4	100	40	30	70
DSE	BOSE-13P	Advance Techniques in Plant Science and Phytopathology	P	III	1	50	20	15	35
DSE	BOSE-14P	Applied Phytochemistry and Pharmacognosy	P	III	1	50	20	15	35
TOTAL					20	600			
DSC	BOSC-11P	Project/Dissertation	P	IV	20	600	240	180	420
		Internal test/Quiz						30	
		Assignment						100	
		Synopsis presentation						50	
		Project report/ Dissertation work							250
		Seminar							100
		Via-voce							70
TOTAL					20	600	240	180	420

टीप :- परीक्षा योजना एवं प्रश्न पत्र के प्रारूप को भी यथावत् लागू करने की अनुषंसा की जाती है। आज दिनांक 15/07/2025 को वनस्पति शास्त्र अध्ययन मंडल की बैठक में निम्नलिखित अध्यक्ष/सदस्य उपस्थित हुये।

क्र.	नाम	पदनाम	अध्यक्ष/सदस्य
1.	डॉ. सुश्री रामकली कुलदीप	सहायक प्राध्यापक	अध्यक्ष
2.	श्री राजीव पाणीग्राही	सहायक प्राध्यापक	सदस्य
3.	डा. मिथिलेश कुमार सिन्हा	सहायक प्राध्यापक	सदस्य
4.	श्री भगवान प्रसाद साहू	सहायक प्राध्यापक	सदस्य

हस्ताक्षर
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BOSC-09T ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

**DEPARTMENT OF BOTANY
COURSE CURRICULUM**

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	SESSION 2025-26
1.	COURSE CODE	BOSC-09T	
2.	COURSE TITLE	Research Methodology and Scientific Writing	
3.	COURSE TYPE	DISCIPLINE SPECIFIC CORE (DSC)	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Understand the Fundamentals of Research Methodology • Design Effective Research Studies • Apply Data Collection Techniques and Statistical Tools • Prepare Scientific Reports and Communicate Research Effectively • Critically Analyse Research Metrics and Tools • Adhere to Research Ethics and Legal Frameworks • Evaluate and Overcome Research Challenges 	
6.	CREDIT VALUE	4 CREDITS	1 CREDIT = 15 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 100	MIN. PASSING MARKS: 40
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 60 PERIODS (60 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
I	Foundations of Research <ul style="list-style-type: none"> • Research Methodology: An Introduction • Definition, Objectives and Motivation of Research • Types of Research • Research Approaches • Significance of Research • Research Methods versus Methodology • Research and Scientific Method • Importance of Knowing How Research is Done • Criteria of Good Research • Problems Encountered by Researchers in India 		15
II	Research Design <ul style="list-style-type: none"> • Meaning and Need of Research Design • Features of a Good Design • Important Concepts Relating to Research Design • Different Research Designs • Basic Principles of Experimental Designs <ul style="list-style-type: none"> ○ The Principle of Replication; ○ The Principle of Randomization; ○ The Principle of Local Control • Important Formal Experimental Designs 		15

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	<ul style="list-style-type: none"> ○ Completely randomized design ○ Randomized block design ○ Latin square design ○ Factorial designs. 	
III	Data Collection Methods and Statistical Analysis in Research <ul style="list-style-type: none"> • Methods of Data Collection: <ul style="list-style-type: none"> ○ Collection of Primary Data ○ Observation Method ○ Interview Method ○ Collection of Data through Questionnaires ○ Collection of Data through Schedules ○ Difference between Questionnaires and Schedules ○ Collection of Secondary Data ○ Guidelines for Constructing Questionnaire/Schedule/Interviewing • Simple regression analysis • Multiple correlation and regression • t-test, ANOVA, Chi-square Test • Parametric or Standard Tests of Hypotheses 	15
IV	Scientific Communication and Research Ethics <ul style="list-style-type: none"> • Scientific Publications: Research (Journal) Paper, Review Paper, Book Chapter, Conference Paper and Abstracts, Theses and Dissertations, Short Communication/Research Note, Monograph. • Organization of a Research Paper: The IMRAD Format • Referencing Styles (Harvard, APA, Vancouver) and Citation Tools (Zotero, Mendeley); • Oral and Poster Presentations • Understanding Impact Factor, h-index, g-index, i10-index • Ethical Use of Artificial Intelligence for Scientific Writing • Ethical Guidelines: Code of Conduct for Fieldwork (The Nagoya Protocol; Access and Benefit Sharing (ABS) Guidelines); Ethics in Human and Animal Use; • Publication Ethics: Double Publishing, Authorship, Plagiarism, Copyright 	15
KEYWORDS	Research Methodology, Research Design, Data Collection & Analysis, Scientific Communication, Research Ethics	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>		

PART C – LEARNIG RESOURCES**TEXT BOOKS, REFERENCE BOOKS AND OTHERS****TEXT BOOKS RECOMMENDED**

- Kothari, C. R., & Garg, G. (2019). Research methodology: Methods and techniques (4th ed.). New Age International Publishers.
- Kumar, R. (2019). Research methodology: A step-by-step guide for beginners (5th ed.). SAGE Publications.
- Booth, W. C., Colomb, G. G., & Williams, J. M. (2016). The craft of research (4th ed.). University of Chicago Press.
- Leedy, P. D., & Ormrod, J. E. (2018). Practical research: Planning and design (12th ed.). Pearson.
- Agarwal, B. L. (2013). Basic statistics (5th Ed.). New Age International Publishers.
- Steneck, N. H. (2007). Introduction to the responsible conduct of research (Revised ed.). U.S. Government Printing Office.

REFERENCE BOOKS RECOMMENDED

- Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.
- Babbie, E. (2020). The practice of social research (15th ed.). Cengage Learning.
- Neuman, W. L. (2014). Social research methods: Qualitative and quantitative approaches (7th ed.). Pearson Education.
- Sekaran, U., & Bougie, R. (2019). Research methods for business: A skill-building approach (8th ed.). Wiley.
- Walliman, N. (2021). Your research project: Designing and planning your work (4th ed.). SAGE Publications.

ONLINE RESOURCES

1. Citation Guides _ Mendeley <https://www.mendeley.com/guides/citation-guides/>
2. Google Scholar Metrics Help <https://scholar.google.com/intl/en/scholar/metrics.html>
3. Steneck, N. H. (2007). ORI Introduction to the Responsible Conduct of Research. Office of Research Integrity, U.S. Department of Health and Human Services. <https://ori.hhs.gov/ori-introduction-responsible-conduct-research>
4. COPE (Committee on Publication Ethics) Guidelines <https://publicationethics.org/guidance/Guidelines>
5. Elsevier's Ethics in Research & Publication Program <https://www.elsevier.com/about/policies/publishing-ethics>
6. Society of Ethnobiology Code of Ethics _ Society of Ethnobiology <https://ethnobiology.org/about-society-ethnobiology/ethics>

PART D – ASSESSMENT AND EVALUATION**SUGGESTED CONTNOUS EVALUATION METHODS:**

MAXIMUM MARKS:	100
CONTINUOUS INTERNAL ASSESSMENT (CIA):	30
END SEMESTER EXAM (ESE):	70

CONTINUOUS INTERNAL ASSESSMENT (CIA): 30 (BY COURSE TEACHER)	INTERNAL TEST/QUIZ (2): 20+20 Assignment/Seminar: 10 Total marks - 30	Better marks out of two test/quiz + obtained marks in assignment shall be considered against 30 marks
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END SEMESTER EXAM
(ESE): 70

Two section A & B
SECTION A: Q1. OBJECTIVE – 10 X 1 = 10 MARK; Q2
SHORT ANSWER TYPE 5 X 4 = 20 MARKS
SECTION B: DESCRIPTIVE ANSWER TYPE QUESTIONS
1 OUT OF 2 FROM EACH UNIT 4 X 10 = 40 MARKS

NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)

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BOSC-10T ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

**DEPARTMENT OF BOTANY
COURSE CURRICULUM**

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	SESSION 2025-26
1.	COURSE CODE	BOSC-10T	
2.	COURSE TITLE	ICT Tools in Research	
3.	COURSE TYPE	DISCIPLINE SPECIFIC CORE (DSC)	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Understand the Role and Evolution of ICT in Research and Education • Utilize Research Databases and Digital Repositories • Apply Word Processing and Presentation Tools for Academic Writing • Perform Data Handling and Visualization Using Spreadsheet Tools • Use Reference Management and Plagiarism Detection Tools • Implement Online Survey, Collaboration, and Communication Tools • Integrate ICT Applications in Botanical and Phytochemical Research 	
6.	CREDIT VALUE	4 CREDITS	CREDIT = 15 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 100	MIN. PASSING MARKS: 40
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 60 PERIODS (60 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
I	Foundations of ICT in Research <ul style="list-style-type: none"> • Organization of computer: Characteristics of computer, Limitations of computer, CPU, Computer peripherals • Internet: History, Email, Features of internet, Web browser, Search engines • Artificial intelligence – based utility tools for research communication • Introduction to research databases: One nation One Subscription, National Digital Library of India, Shodhgangotri, Shodhganga, DOAJ, PubMed • Cybersecurity, data privacy, and digital ethics 		15
II	Documentation, Reference Management, and Academic Writing Tools <ul style="list-style-type: none"> • Word processing tools: MS Word <ul style="list-style-type: none"> ◦ Templates, styles, equations, table of 		15

	<p>contents, formatting thesis, research papers, inserting tables/charts/images, cross-references, reference tools.</p> <ul style="list-style-type: none"> • Presentation tools: PowerPoint <ul style="list-style-type: none"> ○ Creating a Simple Presentation ○ Making Your Presentation Attractive • Data Handling, Analysis, and Visualization Tools: MS Excel: <ul style="list-style-type: none"> ○ Data entry, statistical functions, formulas, graphing, pivot tables for experimental data. • Reference management software: Mendeley, Zotero • Researcher profiles: ORCID, ResearchGate, Google Scholar • Plagiarism checker tools: ShodhShuddhi and etc. 	
III	<p>ICT Tools for Survey, Collaboration, and Dissemination</p> <ul style="list-style-type: none"> • Online surveys and forms: Google Forms, Microsoft Forms • Collaborative platforms: Google Drive, Docs, Sheets, Slides, OneDrive • Communication tools: Zoom, MS Teams, Google Meet • Research dissemination: Preprints, e-journals, conferences, blogs • Journal selection tools: UGC CARE, SCImago, Elsevier Journal Finder • Guide for authors to publish in a research journal 	15
IV	<p>Online Tools and Applications in Botanical Research</p> <ul style="list-style-type: none"> • Plant Taxonomy and Identification Databases: The World Flora Online, eFloraofIndia, India Biodiversity Portal, Chhattisgarh State Biodiversity Board • Biodiversity and Conservation Databases: GBIF, BSI Threatened Plants List • Phytochemical and Ethnobotanical Databases: Dr. Duke's Phytochemical Database, IMPPAT, PubChem • In Silico Tools for Phytochemical-Based Drug Discovery: SwissADME, SwissTargetPrediction • Mobile Applications for Plant Identification and Field Data Collection: PlantNet, iNaturalist 	15
KEYWORDS	ICT, Research Databases, Digital Resources, Academic Writing, Data Analysis, Online Tools	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		

PART C – LEARNIG RESOURCES

TEXT BOOKS, REFERENCE BOOKS AND OTHERS

TEXT BOOKS RECOMMENDED

- Bansal, R. K., & Singh, R. (2021). Information and communication technology in education. Vikas Publishing House.
- Sharma, P., & Sharma, S. K. (2020). ICT tools for research: A handbook for scholars. New Delhi Publishers.
- Cohen, L., Manion, L., & Morrison, K. (2018). Research methods in education (8th ed.). Routledge.
- Srivastava, S. (2022). Microsoft Office for researchers: Word, Excel, PowerPoint & beyond. BPB Publications.
- Leeder, C. (2022). Digital literacy for research: Tools, skills and practices. Rowman & Littlefield.
- Singh, G., & Kaur, R. (2021). Online research tools and academic writing. Kalyani Publishers.
- Pushpangadan, P., & Nair, K. N. (2019). Ethnobotany and medicinal plants: Indian perspectives. Scientific Publishers.

REFERENCE BOOKS RECOMMENDED

- Bansal, R. K., & Shrivastava, R. K. (2020). Information and communication technology in education. APH Publishing Corporation.
- Zhao, Y., & Lei, J. (Eds.). (2021). The handbook of technology and student engagement. Springer.
- Harris, R. (2020). Using MS Word, Excel, and PowerPoint for academic purposes. Cengage Learning.
- Wright, A. M. (2019). Practical research tools for academic writing: Reference management and avoiding plagiarism. Oxford Academic Press.
- Anderson, T., & Dron, J. (2022). Teaching crowds: Learning and social media. AU Press.
- Sharma, J. P., & Verma, R. K. (2021). Research methodology and ICT applications in science. Kalyani Publishers.
- Rajput, M., & Ameta, K. D. (Eds.). (2023). Botanical informatics and ICT applications. Scientific Publishers.

ONLINE RESOURCES

- Government of India. National Digital Library of India (NDLI). Ministry of Education. <https://ndl.iitkgp.ac.in/>
- University Grants Commission (UGC). Shodhganga: A reservoir of Indian theses. INFLIBNET Centre. <https://shodhganga.inflibnet.ac.in/>
- World Flora Online. World Flora Online database. <http://www.worldfloraonline.org/>
- Global Biodiversity Information Facility (GBIF). GBIF: The Global Biodiversity Information Facility. <https://www.gbif.org/>
- PubMed. PubMed: Biomedical literature database. U.S. National Library of Medicine. <https://pubmed.ncbi.nlm.nih.gov/>
- Swiss Institute of Bioinformatics. SwissADME: ADME parameters for small molecules. <http://www.swissadme.ch/>
- ORCID. ORCID: Connecting research and researchers. <https://orcid.org/>

PART D – ASSESSMENT AND EVALUATION

SUGGESTED CONTNOUS EVALUATION METHODS:

MAXIMUM MARKS:

CONTINUOUS INTERNAL ASSESSMENT (CIA)

END SEMESTER EXAM (ESE)		
CONTINUOUS INTERNAL ASSESSMENT (CIA): 30 (BY COURSE TEACHER)	INTERNAL TEST/QUIZ (2): 20+20 Assignment/Seminar: 10 Total marks - 30	Better marks out of two test/quiz + obtained marks in assignment shall be considered against 30 marks
END SEMESTER EXAM (ESE): 70	Two section A & B SECTION A: Q1. OBJECTIVE – 10 X 1 = 10 MARK; Q2 SHORT ANSWER TYPE 5 X 4 = 20 MARKS SECTION B: DESCRIPTIVE ANSWER TYPE QUESTIONS 1 OUT OF 2 FROM EACH UNIT 4 X 10 = 40 MARKS	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
 		

BOSE-13T ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	SESSION 2025-26
1.	COURSE CODE	BOSE-13T	
2.	COURSE TITLE	Advance Techniques in Plant Science and Phytopathology	
3.	COURSE TYPE	DISCIPLINE SPECIFIC ELECTIVE (DSE)	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Understanding Principles and Applications of Microscopy • Competence in Sample Preparation and Imaging Analysis • Application of Biochemical Separation Techniques • Proficiency in Spectroscopic and Molecular Techniques • Identification and Diagnosis of Major Plant Diseases • Understanding of Disease Epidemiology and Forecasting • Implementation of Integrated Disease Management Strategies 	
6.	CREDIT VALUE	3 CREDITS	CREDIT = 15 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 100	MIN. PASSING MARKS: 40
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 45 PERIODS (45 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
I	Microscopy and Imaging Techniques <ul style="list-style-type: none"> • Fundamentals of light microscopy <ul style="list-style-type: none"> ○ Optical Components of the Light Microscope ○ Aperture and Image Planes in a Focused, Adjusted Microscope ○ Koehler Illumination ○ Adjusting the Microscope for Koehler Illumination ○ Fixed Tube Length versus Infinity Optical Systems ○ Precautions for Handling Optical Equipment • Phase contrast microscopy <ul style="list-style-type: none"> ○ The Behaviour of Waves from Phase Objects in Brightfield Microscopy • Darkfield microscopy • Fluorescence microscopy <ul style="list-style-type: none"> ○ Applications of Fluorescence Microscopy ○ Physical Basis of Fluorescence ○ Properties of Fluorescent Dyes ○ Fluorescent Dyes and Proteins in Fluorescence 		10

	<p>Microscopy</p> <ul style="list-style-type: none"> ○ Quenching, Blinking, and Photobleaching ○ Examining Fluorescent Molecules in Living Cells • Confocal laser scanning microscopy <ul style="list-style-type: none"> ○ The Optical Principle of Confocal Imaging ○ Advantages of CLSM over Widefield Fluorescence Systems ○ Criteria Defining Image Quality and the Performance of an Electronic Imaging System ○ Confocal Adjustments and Their Effects on Imaging ○ Photobleaching ○ General Procedure for Acquiring a Confocal Image ○ Performance Check of a Confocal System 	
II	<p>Biochemical and Molecular Techniques</p> <ul style="list-style-type: none"> • Chromatography Techniques: Paper, Thin-Layer (TLC), Column, HPLC, GC • Spectroscopy: UV-Vis, Fluorescence, IR, NMR (basic principles and applications) • Electrophoresis: Agarose and SDS-PAGE • DNA/RNA Extraction Methods in Plants • PCR and RT-PCR: Basics and Applications • ELISA and Immunoassays • Centrifugation: Principle and Applications in Plant Biochemistry 	11
III	<p>Plant Diseases:</p> <ul style="list-style-type: none"> • Fungal Diseases: Blast of rice, rusts of wheat, wilt of pigeon pea, powdery mildew of soybean, tikka disease of groundnut, wilt of tomato, die-back of chilli, Panama wilt of banana. • Bacterial Diseases: Bacterial leaf blight of rice, citrus canker, bacterial wilt of tomato, bacterial wilt of brinjal. • Viral Diseases: Yellow mosaic of pulses, bud necrosis of groundnut, leaf curl of tomato, bunchy top of banana. • Nematode Diseases: Root-knot of vegetables, cyst nematode of soybean. 	12
IV	<p>Diagnosis and Management of Plant Diseases:</p> <ul style="list-style-type: none"> • Epidemiology of plant diseases and factors affecting their spread; • Disease forecasting and modelling; • Cultural and mechanical methods of disease management; • Chemical control methods including types and modes of action of fungicides and bactericides; • Biological control using antagonistic organisms; • Host resistance mechanisms and breeding for disease resistance; • Principles and strategies of integrated disease management. 	12
KEYWORDS	Microscopy, Biochemical & Molecular Techniques, Plant Pathology, Disease Diagnosis, Disease Management	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		

PART C – LEARNIG RESOURCES

TEXT BOOKS, REFERENCE BOOKS AND OTHERS

TEXT BOOKS RECOMMENDED

- Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). Biochemistry & molecular biology of plants (2nd ed.). Wiley Blackwell.
- Slayter, E. M., & Slayter, H. S. (1992). Light and electron microscopy. Cambridge University Press.
- Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of instrumental analysis (7th ed.). Cengage Learning.
- Agrios, G. N. (2005). Plant pathology (5th ed.). Elsevier Academic Press.
- Mehrotra, R. S., & Aggarwal, A. (2013). Plant pathology (3rd ed.). Tata McGraw-Hill Education.

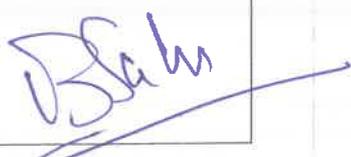
REFERENCE BOOKS RECOMMENDED

- Meyers, R. A. (Ed.). (2008). Encyclopedia of analytical chemistry: Applications, theory and instrumentation. Wiley.
- Murphy, D. B., & Davidson, M. W. (2012). Fundamentals of light microscopy and electronic imaging (2nd ed.). Wiley-Blackwell.
- Nelson, P. E., Maloy, O. C., & Agrios, G. N. (2005). Plant pathology (5th ed.). Academic Press.
- Plummer, D. T. (1987). An introduction to practical biochemistry (3rd ed.). McGraw-Hill Education.
- Trigiano, R. N., Windham, M. T., & Windham, A. S. (2004). Plant pathology: Concepts and laboratory exercises (2nd ed.). CRC Press.

ONLINE RESOURCES

- National Center for Biotechnology Information. Microscopy and imaging techniques. PubMed Central. <https://www.ncbi.nlm.nih.gov/pmc/>
- Thermo Fisher Scientific. Types of microscopes and their applications. <https://www.thermofisher.com/in/en/home/life-science/cell-analysis/microscopy.html>
- Bio-Rad Laboratories. Chromatography principles and applications. <https://www.bio-rad.com/en-in/category/chromatography>
- Thermo Fisher Scientific. Spectroscopy learning center. <https://www.thermofisher.com/in/en/home/industrial/spectroscopy.html>
- Addgene. Molecular biology protocols: DNA, RNA, PCR, electrophoresis. <https://www.addgene.org/protocols/>
- American Phytopathological Society. Plant disease management and diagnostic resources. <https://www.apsnet.org/edcenter/disandpath/>
- Plantwise Knowledge Bank. Plant health information and disease management practices. <https://www.plantwise.org/KnowledgeBank>

PART D – ASSESSMENT AND EVALUATION

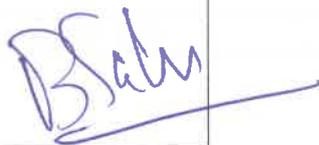
SUGGESTED CONTINUOUS EVALUATION METHODS: MAXIMUM MARKS: CONTINUOUS INTERNAL ASSESSMENT (CIA) END SEMESTER EXAM (ESE)		
CONTINUOUS INTERNAL ASSESSMENT (CIA): 30 (BY COURSE TEACHER)	INTERNAL TEST/QUIZ (2): 20+20 Assignment/Seminar: 10 Total marks - 30	Better marks out of two test/quiz + obtained marks in assignment shall be considered against 30 marks
END SEMESTER EXAM (ESE): 70	Two section A & B SECTION A: Q1. OBJECTIVE – 10 X 1 = 10 MARK; Q2 SHORT ANSWER TYPE 5 X 4 = 20 MARKS SECTION B: DESCRIPTIVE ANSWER TYPE QUESTIONS 1 OUT OF 2 FROM EACH UNIT 4 X 10 = 40 MARKS	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
 		

BOSE-14T ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

**DEPARTMENT OF BOTANY
COURSE CURRICULUM**

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	SESSION 2025-26
1.	COURSE CODE	BOSE-14T	
2.	COURSE TITLE	Applied Phytochemistry and Pharmacognosy	
3.	COURSE TYPE	DISCIPLINE SPECIFIC ELECTIVE (DSE)	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Understanding the Fundamentals and Scope of Phytochemistry • Classification and Biosynthesis of Plant Secondary Metabolites • Role of Secondary Metabolites in Plant Defence and Human Health • Extraction and Isolation Techniques for Phytochemicals • Analytical and Spectroscopic Techniques in Phytochemistry • Pharmacogenetic Identification and Quality Control of Herbal Drugs • Application of Ethnopharmacology in Herbal Drug Discovery 	
6.	CREDIT VALUE	3 CREDITS	CREDIT = 15 HOURS – LEARNING & OBSERVATION

7.	TOTAL MARKS	MAX MARKS: 100	MIN. PASSING MARKS: 40
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 45 PERIODS (45 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
I	Fundamentals of Phytochemistry <ul style="list-style-type: none"> • Sources, Classification and Quality Control of Crude Drugs <ul style="list-style-type: none"> ○ Introduction of pharmacognosy ○ Historical development of pharmacognosy ○ Developmental events ○ Scope of pharmacognosy ○ Sources of drugs ○ Classification of crude drugs ○ Quality control of crude drugs ○ Drug evaluation • Role of Pharmacognosy and Plant Secondary Metabolite <ul style="list-style-type: none"> ○ Pharmacognosy in various systems of medicine <ul style="list-style-type: none"> ▪ Tannin ▪ Glycosides ▪ Flavonoids ▪ Resins ○ Secondary metabolites <ul style="list-style-type: none"> ▪ Alkaloids ▪ Volatile oils • Metabolic Pathways in Higher Plants and their Determination <ul style="list-style-type: none"> ○ Shikimic acid pathway (SAP) ○ Acetate pathways ○ Amino acid pathway 		12
II	Pharmacognosy and Herbal Drug Identification <ul style="list-style-type: none"> • Drug Adulteration: Intentional and unintentional adulteration • Evaluation of Crude Drugs: organoleptic, microscopic, physical, chemical, and biological parameters • Biological Screening of Herbal Drugs <ul style="list-style-type: none"> ○ Screening methods for analgesic agents ○ Screening methods for antidiabetic agents • General Methods for Extraction, Isolation and Identification of Herbal Drugs <ul style="list-style-type: none"> ○ Extraction Methods ○ Percolation ○ Continuous Extraction ○ Types of Extracts ○ Isolation And Identification of Natural Products • Isolation of Phytopharmaceuticals <ul style="list-style-type: none"> ○ Isolation of caffeine, camphor, colchicine, capsaicin 		10
III	Modern Analytical Techniques for Quality Control and Chemical Identification of Phytochemical <ul style="list-style-type: none"> • Chromatographic Techniques: High-performance Liquid Chromatography, Gas Chromatography, Thin-layer 		12

	<p>Chromatography and High-performance Thin-layer Chromatography</p> <ul style="list-style-type: none"> • Spectroscopic Techniques: Ultraviolet-visible Spectroscopy, Fourier Transform Infrared Spectroscopy, Nuclear Magnetic Resonance • Mass Spectrometry: Structural Elucidation of Phytochemicals by Mass Spectrometry, Quantitative Analysis and Quality Control Measures • Hyphenated Techniques: LC-MS and GC-MS Applications in Phytochemical Analysis, LC-NMR-MS for Comprehensive Structural Elucidation 	
IV	<p>Ethnopharmacology</p> <ul style="list-style-type: none"> • Ethnopharmacology: Ethnopharmacology and Traditional Medicine, Ethnobotany/Ethnopharmacology and Mass Bioprospecting. • Ethnopharmacology of Algae, Lichen, Bryophytes, ferns, orchids • Ethnopharmacology of <i>Alstonia macrophylla</i> ex A. DC; <i>Terminalia bellerica</i> (Gaertn.) Roxb • Role of AYUSH, National Medicinal Plants Board, and Pharmacopoeial Laboratory for Indian Medicine 	11
KEYWORDS	Phytochemistry, Secondary Metabolites, Pharmacognosy, Analytical Techniques, Ethnopharmacology	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
 		

PART C – LEARNIG RESOURCES
TEXT BOOKS, REFERENCE BOOKS AND OTHERS
TEXT BOOKS RECOMMENDED
<ul style="list-style-type: none"> • Evans, W. C. (2009). Trease and Evans' Pharmacognosy (16th ed.). Saunders Ltd. • Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2019). Pharmacognosy (51st ed.). Nirali Prakashan. • Dewick, P. M. (2009). Medicinal natural products: A biosynthetic approach (3rd ed.). Wiley. • Mukherjee, P. K. (2019). Quality control and evaluation of herbal drugs: Evaluating natural products and traditional medicine (2nd ed.). Elsevier. • Heinrich, M., Barnes, J., Gibbons, S., & Williamson, E. M. (2012). Fundamentals of pharmacognosy and phytotherapy (2nd ed.). Churchill Livingstone.
REFERENCE BOOKS RECOMMENDED
<ul style="list-style-type: none"> • Harborne, J. B. (1998). Phytochemical methods: A guide to modern techniques of plant analysis (3rd ed.). Springer. • Wagner, H., & Bladt, S. (2001). Plant drug analysis: A thin layer chromatography atlas

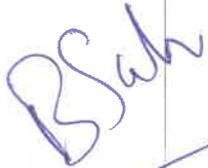
<p>(2nd ed.). Springer.</p> <ul style="list-style-type: none"> Sarker, S. D., Latif, Z., & Gray, A. I. (2006). Natural products isolation (2nd ed.). Humana Press. 		
<p>ONLINE RESOURCES</p> <ul style="list-style-type: none"> World Health Organization. (2004). WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. https://apps.who.int/iris/handle/10665/42783 National Center for Biotechnology Information. Phytochemicals. PubChem. https://pubchem.ncbi.nlm.nih.gov/ AYUSH Ministry. About the Ministry of AYUSH. Government of India. https://www.ayush.gov.in/ National Medicinal Plants Board. Medicinal plant database. https://www.nmpb.nic.in/ Indian Pharmacopoeia Commission. (2021). Indian pharmacopoeia 2020. https://ipc.gov.in/ 		
<p>PART D – ASSESSMENT AND EVALUATION</p>		
<p>SUGGESTED CONTINUOUS EVALUATION METHODS: MAXIMUM MARKS: CONTINUOUS INTERNAL ASSESSMENT (CIA) END SEMESTER EXAM (ESE)</p>		
<p>CONTINUOUS INTERNAL ASSESSMENT (CIA): 30 (BY COURSE TEACHER)</p>	<p>INTERNAL TEST/QUIZ (2): 20+20 Assignment/Seminar: 10 Total marks - 30</p>	<p>Better marks out of two test/quiz + obtained marks in assignment shall be considered against 30 marks</p>
<p>END SEMESTER EXAM (ESE): 70</p>	<p>Two section A & B SECTION A: Q1. OBJECTIVE – 10 X 1 = 10 MARK; Q2 SHORT ANSWER TYPE 5 X 4 = 20 MARKS SECTION B: DESCRIPTIVE ANSWER TYPE QUESTIONS 1 OUT OF 2 FROM EACH UNIT 4 X 10 = 40 MARKS</p>	
<p>NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)</p>		
<p> </p>		

BOSE-15T ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	SESSION 2025-26
1.	COURSE CODE	BOSE-15T	
2.	COURSE TITLE	Forensic Botany & Agricultural Nanotechnology	
3.	COURSE TYPE	DISCIPLINE SPECIFIC ELECTIVE (DSE)	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Understand the Fundamental Principles and Scope of Forensic Botany • Identify and Analyse Botanical Evidence in Criminal Investigations • Demonstrate Competence in Classical and Molecular Techniques Used in Forensic Botany • Apply Nanotechnology Concepts in Plant Sciences and Evaluate Their Interactions • Analyse the Role of Nanobiotechnology in Sustainable Agriculture and Crop Protection • Interpret and Utilize Analytical Techniques for Characterization of Nanoparticles 	
6.	CREDIT VALUE	4 CREDITS	CREDIT = 15 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 100	MIN. PASSING MARKS: 40
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 60 PERIODS (60 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
I	Fundamentals and Classical Approaches in Forensic Botany <ul style="list-style-type: none"> • Introduction to Forensic Botany • The Use of Biological and Botanical Evidence in Criminal Investigations • Uses of Plant Anatomy, Taxonomy, and Ecology in Forensic Investigations • Evidence Collection and Analysis • Forensic Palynology • Use of Diatoms and Pollen for Seasonal Calendar • Wooden Stick Matches as Forensic Evidence 		15
II	Advanced Techniques and Legal Aspects in Forensic Botany <ul style="list-style-type: none"> • Plant Poisons and Toxicology • An Overview of Historical Developments in Forensic DNA Analysis • Use and Guidelines for Plant DNA Analyses in Forensics 		15

	<ul style="list-style-type: none"> • Classical and Future DNA Typing Technologies for Plants • Plant Identification by DNA • Legal Considerations for Acceptance of New Forensic Methods in Court • Forensic Botany Cases 	
III	Fundamentals of Nanotechnology and Its Interface with Plants <ul style="list-style-type: none"> • Introduction to Nanotechnology <ul style="list-style-type: none"> ○ History of Nanoscience and Nanotechnology ○ Definition and classification of Nanomaterials • Synthesis of Nanoparticles <ul style="list-style-type: none"> ○ Physical methods, ○ Chemical methods, and ○ Biological (green synthesis) methods • Characterization of Nanoparticles <ul style="list-style-type: none"> ○ Techniques: SEM, TEM, XRD, FTIR, UV-Vis • Plant and Nanoparticle Interface at the Molecular Level <ul style="list-style-type: none"> ○ Uptake and Translocation of NPs in Plants ○ Effects of Nanoparticles on Plants ○ Mechanism of Phytotoxicity in Plants Generated by NPs ○ Effect of NPs on Genomics ○ Effect of NPs on Transcriptomics ○ Effect of NPs on Proteomics 	15
IV	Advances in Agricultural Nanobiotechnology <ul style="list-style-type: none"> • Agricultural Nanobiotechnology: Current Possibilities and Constraints • Nanofertilizer Development and Importance in Nutrient Management • Polymeric Nano-fungicides for the Management of Fungal Diseases in Crops • Nano-enabled Pesticides • Nanophytovirology Approach to Combat Plant Viral Diseases • Nanobiosensors for Monitoring Soil and Water Health • Nanobioformulation for Sustainable Agriculture 	15
KEYWORDS	Forensic Botany, Palynology, Plant Toxicology, Nanotechnology in Plant Science, Nanoparticle-Plant Interactions, Agricultural Nanotechnology	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
 		

PART C – LEARNIG RESOURCES

TEXT BOOKS, REFERENCE BOOKS AND OTHERS

TEXT BOOKS RECOMMENDED

- Coyle, H. M. (Ed.). (2005). *Forensic botany: Principles and applications to criminal casework*. CRC Press.
- Dickinson, M. B. (Ed.). (2019). *Forensic plant science*. Academic Press.
- Hall, D. W. (2011). *Introduction to forensic botany*. University Press of Florida.
- Trivedi, P. C. (2012). *Nanotechnology and plant sciences*. Pointer Publishers.
- Rai, M., Ribeiro, C., Mattoso, L., & Duran, N. (Eds.). (2015). *Nanotechnologies in food and agriculture*. Springer.
- Mishra, A., & Mishra, R. K. (2021). *Nanotechnology in agriculture: Fundamentals and applications*. Springer.
- Kumar, V., & Dasgupta, N. (Eds.). (2019). *Nanotechnology in agro-food: Applications, challenges, and perspectives*. Springer.

REFERENCE BOOKS RECOMMENDED

- Bock, J. H., & Norris, D. O. (2016). *Forensic botany: A practical guide*. Wiley-Blackwell.
- Hall, D. W. (2011). *Introduction to forensic botany: Principles and applications*. CRC Press.
- Coyle, H. M. (Ed.). (2005). *Forensic botany: Principles and applications to criminal casework*. CRC Press.
- Sharma, P. K., & Pundir, C. S. (Eds.). (2021). *Nanotechnology: Principles and practices in agriculture and food sciences*. Springer.
- Rai, M., Ribeiro, C., Mattoso, L., & Duran, N. (Eds.). (2015). *Nanotechnologies in food and agriculture*. Springer.
- Parisi, C., Vigani, M., & Rodríguez-Cerezo, E. (2015). *Agricultural nanotechnologies: What are the current possibilities?*. European Commission, Joint Research Centre.
- Dasgupta, N., Ranjan, S., Tripathi, D. K., & Lichtfouse, E. (Eds.). (2019). *Nanoscience in agriculture: Applications and perspectives*. Springer.

ONLINE RESOURCES

- Chikara, S., Nag, D., & Paroha, S. (2021). *Forensic botany: An overview of its forensic application*. *Forensic Research & Criminology International Journal*, 9(1), 19–24. <https://doi.org/10.15406/frcij.2021.09.00327>
- Hall, D. W. (2011). *Forensic botany: An under-utilized resource*. In R. A. Meyers (Ed.), *Encyclopedia of Sustainability Science and Technology*. Springer. https://doi.org/10.1007/978-1-4419-0851-3_155
- Graham, E. A., & Ford, B. (2022). *DNA barcoding in forensic botany: A review of plant identification methods*. *Forensic Science International: Genetics*, 57, 102659. <https://doi.org/10.1016/j.fsigen.2021.102659>
- Bryant, V. M., & Jones, J. G. (2006). *Forensic palynology: Current status of a rarely used technique in criminal investigations*. *Forensic Science International*, 163(3), 183–197. <https://doi.org/10.1016/j.forsciint.2005.11.015>
- Rai, M., Ingle, A. P., Paralikar, P., & da Silva, S. S. (2021). *Nanotechnology for plant disease management*. *Environmental Chemistry Letters*, 19, 1295–1304. <https://doi.org/10.1007/s10311-020-01098-3>
- Kah, M., Kookana, R. S., Gogos, A., & Bucheli, T. D. (2018). *A critical evaluation of nanopesticides and nanofertilizers against their conventional analogues*. *Nature Nanotechnology*, 13(8), 677–684. <https://doi.org/10.1038/s41565-018-0131-1>
- Majumder, S., & Ghosh, S. (2020). *Green synthesis and characterization of*

nanoparticles: A review on the biosynthesis of nanoparticles. Journal of Nanotechnology, 2020, 1–20. <https://doi.org/10.1155/2020/8025285>

PART D – ASSESSMENT AND EVALUATION

SUGGESTED CONTINUOUS EVALUATION METHODS:

MAXIMUM MARKS: 600

CONTINUOUS INTERNAL ASSESSMENT (CIA) 180

END SEMESTER EXAM (ESE) 420

CONTINUOUS INTERNAL ASSESSMENT (CIA): 180
(BY COURSE TEACHER)

INTERNAL TEST/QUIZ
(2): 80+80
Assignment/Seminar: 100
Total marks - 30

Better marks out of two test/quiz + obtained marks in assignment shall be considered against 30 marks

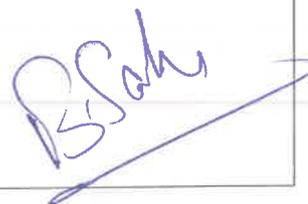
END SEMESTER EXAM (ESE): 420

Laboratory / field skill performance on spot assessment

- Perform the task based on lab work 20 marks
- Spotting based on tools and technology (written) – 10 marks
- Viva voce – 05 marks

Managed by course teacher as per lab status

NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)



BOSE-13P ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

**DEPARTMENT OF BOTANY
COURSE CURRICULUM**

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	
		SESSION 2025-26	
1.	COURSE CODE	BOSE-13P	
2.	COURSE TITLE	Lab Course 13 – Advance Techniques in Plant Science and Phytopathology	
3.	COURSE TYPE	Laboratory Course	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Operate and Maintain Compound Light Microscope and Perform Basic Staining Techniques • Calibrate Ocular Micrometer and Accurately Measure Microbial or Cell Structures • Capture and Analyse Biological Images Using Digital Imaging Tools and ImageJ Software • Perform Chromatographic Techniques to Separate and Identify Plant Metabolites • Quantify Pigments Using UV-Vis Spectrophotometry with Emphasis on Chlorophyll Estimation • Extract, Visualize, and Assess Nucleic Acids and Proteins Using Gel Electrophoresis Techniques • Identify and Isolate Plant Pathogens Including Fungi, Bacteria, Viruses, and Nematodes 	
6.	CREDIT VALUE	1 CREDITS	CREDIT = 30 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 50	MIN. PASSING MARKS: 20
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 30 PERIODS (30 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
LAB/FIELD TRAINING/EXPERIMENT CONTENTS OF COURSE	<ul style="list-style-type: none"> • Handling of Compound Light Microscope & Sample Staining • Micrometry: Calibration & Measurement of Cell Size • Digital Imaging & ImageJ Software Analysis • Thin Layer & Paper Chromatography of Plant Extracts • UV-Vis Spectrophotometry for Chlorophyll Estimation • DNA Extraction from Leaf Samples • Agarose Gel Electrophoresis of DNA • SDS-PAGE for Protein Profiling • Study of Fungal Diseases (e.g., rust, wilt, mildew) • Isolation of Bacterial Pathogens from Plants • Study of Viral and Nematode Diseases • Identification and Diagnosis of Plant Diseases Using Plantix 		30

KEYWORDS	Microscopy, Chromatography, Spectrophotometry, Molecular Techniques, Digital Image Analysis, Plant Pathogen Identification
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)	
 	

PART C – LEARNIG RESOURCES

TEXT BOOKS, REFERENCE BOOKS AND OTHERS

TEXT BOOKS RECOMMENDED

- Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). Biochemistry and molecular biology of plants (2nd ed.). Wiley Blackwell.
- Dubey, R. C. (2014). A textbook of biotechnology (5th ed.). S. Chand Publishing.
- Glick, B. R., & Pasternak, J. J. (2010). Molecular biotechnology: Principles and applications of recombinant DNA (4th ed.). ASM Press.
- Nelson, D. L., & Cox, M. M. (2021). Lehninger principles of biochemistry (8th ed.). W. H. Freeman.
- Aneja, K. R. (2017). Experiments in microbiology, plant pathology and biotechnology (5th ed.). New Age International Publishers.
- Plummer, D. T. (2017). An introduction to practical biochemistry (3rd ed.). McGraw-Hill Education.
- Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A., Ploegh, H., ... & Darnell, J. (2016). Molecular cell biology (8th ed.). W. H. Freeman.

REFERENCE BOOKS RECOMMENDED

- Sambrook, J., & Russell, D. W. (2001). Molecular cloning: A laboratory manual (3rd ed.). Cold Spring Harbor Laboratory Press.
- Singh, R. S. (2018). Plant pathology (5th ed.). Oxford & IBH Publishing.
- Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry (9th ed.). Cengage Learning.
- Slonczewski, J. L., & Foster, J. W. (2017). Microbiology: An evolving science (5th ed.). W.W. Norton & Company.

ONLINE RESOURCES

- OpenStax. (2023). Microscopy. In Biology 2e (2nd ed.). OpenStax. <https://openstax.org/books/biology-2e/pages/2-1-early-microscopes>
- Thermo Fisher Scientific. Micrometry and cell measurement using light microscopy. <https://www.thermofisher.com/in/en/home/references/gibco-cell-culture-basics/cell-culture-protocols/cell-measurement.html>
- National Institutes of Health. ImageJ: Image processing and analysis in Java. <https://imagej.nih.gov/ij/>
- Bio-Rad Laboratories. Chromatography techniques: Paper and thin-layer chromatography. <https://www.bio-rad.com/en-us/applications-technologies/chromatography-techniques>
- Bio-Rad Laboratories. Spectrophotometry: Principles and applications. <https://www.bio-rad.com/en-us/product/spectrophotometers>

- Carolina Biological. DNA extraction from plant tissue. <https://www.carolina.com/teacher-resources/Interactive/dna-extraction-from-onion/tr10829.tr>
- Khan Academy. Gel electrophoresis. <https://www.khanacademy.org/test-prep/mcat/chemical-processes/dna-technologies/a/gel-electrophoresis>

PART D – ASSESSMENT AND EVALUATION

SUGGESTED CONTINUOUS EVALUATION METHODS:

MAXIMUM MARKS: 50

CONTINUOUS INTERNAL ASSESSMENT (CIA) 15

END SEMESTER EXAM (ESE) 35

CONTINUOUS INTERNAL ASSESSMENT (CIA): 15	INTERNAL TEST/QUIZ (2): 10+10 Assignment/Seminar: 05 Total marks - 15	Better marks out of two test/quiz + obtained marks in assignment shall be considered against 15 marks
END SEMESTER EXAM (ESE): 35	Laboratory / field skill performance on spot assessment <ul style="list-style-type: none"> • Perform the task based on lab work 20 marks • Spotting based on tools and technology (written) – 10 marks • Viva voce – 05 marks 	Managed by course teacher as per lab status

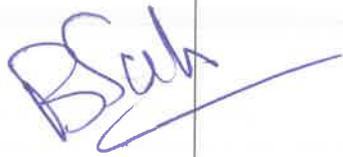
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)




BOSE-14P ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

**DEPARTMENT OF BOTANY
COURSE CURRICULUM**

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER -III	SESSION 2025-26
1.	COURSE CODE	BOSE-14P	
2.	COURSE TITLE	Lab Course 14 – Applied Phytochemistry and Pharmacognosy	
3.	COURSE TYPE	Laboratory Course	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Perform Preliminary Phytochemical Screening of Major Secondary Metabolites • Document and Analyse Indigenous Knowledge from Traditional Healers • Conduct Chemical Identification Tests for Natural Substances and Excipients • Determine Key Leaf Microscopic Parameters for Crude Drug Evaluation • Quantify Morphological and Anatomical Features of Plant Tissues • Evaluate Physicochemical Parameters of Crude Drugs and Herbal Materials • Utilize In Silico Tools for Phytochemical Structure Visualization and Drug-Likeness Analysis 	
6.	CREDIT VALUE	1 CREDITS	1 CREDIT = 30 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 50	MIN. PASSING MARKS: 20
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 30 PERIODS (30 HOURS)			
UNIT	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
LAB/FIELD TRAINING / EXPERIMENT CONTENTS OF COURSE	<ul style="list-style-type: none"> • Preliminary phytochemical screening tests for alkaloids, flavonoids, phenolics, tannins, terpenoids, steroids, saponins, glycosides • Indigenous Knowledge Documentation: Interview or survey of traditional healers/herbal practitioners. • Chemical test: for tragacanth, acacia, agar, gelatine, starch, castor oil • Determination of stomatal number • Determination of stomatal index • Determination of vein islet and vein termination number • Determination of palisade ratio • Determination of size of starch grain • Determination of calcium oxalate crystals • Determination of fibre length and width • Determination of number of starch grain by lycopodium 		30

	spore method. <ul style="list-style-type: none"> • Determination of ash value • Determination of water-soluble extractive value of ginger • Determination of alcohol soluble extractive value of ginger • Determination of moisture content of crude drug • Determination of swelling and foaming index • Retrieval of Phytochemical Structures in .mol / .sdf Format: Download and visualize phytochemical structures using ChemSketch. • Drug-Likeness and ADMET Analysis: Use of tools like SwissADME to predict pharmacokinetics and toxicity. 	
KEYWORDS	Phytochemical Screening, Ethnobotanical Survey, Microscopic Evaluation, Physicochemical Analysis, ADMET Prediction	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
 		

PART C – LEARNIG RESOURCES
TEXT BOOKS, REFERENCE BOOKS AND OTHERS
TEXT BOOKS RECOMMENDED
<ul style="list-style-type: none"> • Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2019). Pharmacognosy (50th ed.). Pune: Nirali Prakashan. • Trease, G. E., & Evans, W. C. (2009). Trease and Evans' Pharmacognosy (16th ed.). Saunders Elsevier. • Khandelwal, K. R. (2013). Practical Pharmacognosy: Techniques and Experiments (23rd ed.). Pune: Nirali Prakashan. • Tyler, V. E., Brady, L. R., & Robbers, J. E. (1988). Pharmacognosy (9th ed.). Lea & Febiger. • Wallis, T. E. (1985). Textbook of Pharmacognosy (5th ed.). CBS Publishers & Distributors. • Heinrich, M., Barnes, J., Gibbons, S., & Williamson, E. M. (2012). Fundamentals of Pharmacognosy and Phytotherapy (2nd ed.). Churchill Livingstone Elsevier.
REFERENCE BOOKS RECOMMENDED
<ul style="list-style-type: none"> • Harborne, J. B. (1998). Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis (3rd ed.). Dordrecht, Netherlands: Springer. • Evans, W. C. (2009). Trease and Evans Pharmacognosy (16th ed.). Edinburgh, UK: Saunders Elsevier. • Mukherjee, P. K. (2019). Quality Control and Evaluation of Herbal Drugs: Evaluating Natural Products and Traditional Medicine (2nd ed.). Amsterdam, Netherlands: Elsevier. • Sofowora, A. (2008). Medicinal Plants and Traditional Medicine in Africa (3rd ed.).

Ibadan, Nigeria: Spectrum Books Ltd.

ONLINE RESOURCES

- Swiss Institute of Bioinformatics. SwissADME: A free web tool to evaluate pharmacokinetics, drug-likeness and medicinal chemistry friendliness of small molecules. <https://www.swissadme.ch/>
- ACD/Labs. ACD/ChemSketch: Free chemical structure drawing software. <https://www.acdlabs.com/resources/freeware/chemsketch/>
- National Center for Biotechnology Information. PubChem Compound Summary. <https://pubchem.ncbi.nlm.nih.gov/>
- Khan Academy. Plant biology and plant anatomy. <https://www.khanacademy.org/science/biology/plants>
- World Health Organization. (2000). General guidelines for methodologies on research and evaluation of traditional medicine. <https://apps.who.int/iris/handle/10665/66783>
- Indian Journal of Traditional Knowledge. Documentation and validation of indigenous knowledge. <https://nopr.niscair.res.in/handle/123456789/42>
- ResearchGate. Standardization of herbal drugs - A review. <https://www.researchgate.net/>

PART D – ASSESSMENT AND EVALUATION

SUGGESTED CONTINUOUS EVALUATION METHODS:

MAXIMUM MARKS: 50

CONTINUOUS INTERNAL ASSESSMENT (CIA) 15

END SEMESTER EXAM (ESE) 35

CONTINUOUS INTERNAL ASSESSMENT (CIA): 15	INTERNAL TEST/QUIZ (2): 10+10 Assignment/Seminar: 05 Total marks - 15	Better marks out of two test/quiz + obtained marks in assignment shall be considered against 15 marks
END SEMESTER EXAM (ESE): 35	Laboratory / field skill performance on spot assessment <ul style="list-style-type: none">• Perform the task based on lab work 20 marks• Spotting based on tools and technology (written) – 10 marks• Viva voce – 05 marks	Managed by course teacher as per lab status

NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)



BOSC-11P ONE YEAR POSTGRADUATE PROGRAM (2025 – 26)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART A – INTRODUCTION			
PROGRAM: MASTER IN BOTANY		SEMESTER - IV	SESSION 2025-26
1.	COURSE CODE	BOSC-11P	
2.	COURSE TITLE	Project/Dissertation	
3.	COURSE TYPE	DISCIPLINE SPECIFIC CORE	
4.	PRE-REQUISITE (IF ANY)	AS PER PROGRAM	
5.	COURSE LEARNING OUTCOMES (CLO)	<ul style="list-style-type: none"> • Research Problem Identification and Formulation • Literature Survey and Critical Analysis • Experimental Design and Methodology Development • Data Collection, Analysis, and Interpretation • Use of Laboratory and Field Techniques • Scientific Communication and Report Writing Skills • Ethical and Professional Research Practices 	
6.	CREDIT VALUE	20 CREDITS	1 CREDIT = 15 HOURS – LEARNING & OBSERVATION
7.	TOTAL MARKS	MAX MARKS: 600	MIN. PASSING MARKS: 240
PART B – CONTENT OF THE COURSE			
TOTAL NO. OF TEACHING LEARNING PERIODS (01 HR. PER PERIOD) = 300 PERIODS (300 HOURS)			
MODULE	TOPICS (COURSE CONTENTS)		NO. OF PERIODS
LAB/FIELD TRAINING / EXPERIMENT CONTENTS OF COURSE	<ul style="list-style-type: none"> • To prepare dummy word document of Ph.D. synopsis with proper formatting. • To prepare a systemic literature review using 20 references related to your research work in standard format. • Write a covering letter to the editor of a journal to publish a manuscript. • Create an Oral and Poster Presentations for Seminars and Conferences. • Draft a project proposal to a funding agency. • Create account in Google scholar, ResearchGate and Academia. • Literature search using Google scholar, PubMed and One Nation One Subscription • Prepare library of references using Mendeley etc. • To prepare a map of study area. • To perform data analysis using a dummy data set. • Hypothesis testing by t- test, chi-square test etc. 		300
	Guidelines for Submission of Project Report/Dissertation work		

A research project report is to be submitted in accordance with the guidelines mentioned below:

1. Number of Copies:

Each student must submit **one hardbound copy** of the project report along with a **CD/DVD containing the soft copy** (in .doc/.pdf format) of the complete project.

2. Individual Work:

Every student must submit a **separate and original project** focused on a botanical research topic. Collaborative submissions are not allowed.

3. Approval Process:

The project report must be submitted to the **Head of Department (HOD) / Project Supervisor** for review. The HOD/Guide may either approve the report or suggest modifications. Final submission is subject to acceptance after revision, if required.

4. Format and Presentation of Project Report:

I. Paper Quality:

Use **A4 size, white bond paper** for the final version. The submitted copy must be original; photocopies may be used for departmental libraries or personal use.

II. Typing and Print:

- Typed in **standard letter size**, double-spaced.
- Use **black ink**.
- Print only on **one side** of the paper.

III. Page Margins:

- **Left:** 35 mm
- **Right:** 20 mm
- **Top:** 35 mm
- **Bottom:** 20 mm

IV. Binding:

The final report must be **hardbound in black Rexene**. Spiral or plastic bindings are **not acceptable**.

V. Front Cover Layout:

Include the following on the front cover:

- **Top:** Title of the Project in uppercase (6mm to 15mm font size)
- **Centre:** Full name of the candidate in uppercase (6mm to 10mm font size)
- **Bottom:** Name of the University/College and year of submission, all in uppercase.

VI. Blank Sheets:

Two blank white sheets (for binding protection) must be placed at the **beginning and end** of the report.

5. Abstract:

Following the Institute Certificate, an **abstract** must be included summarizing the project's core objectives, methodologies, major findings, and significance in botanical research.

6. Certificates and Preliminary Pages:

Include the following (in order):

- **Institute Certificate** – Authenticated by HOD/Supervisor.
- **Acknowledgment**
- **List of Figures**
- **List of Tables**
- **Nomenclature and Abbreviations** (if applicable)

7. Chapter-wise Contents of the Project Report:

I. Introduction:

Provide a detailed background of the **botanical research problem**, relevance of the study, research objectives, and chapter outline.

II. Scope of Work:

Define the **extent and boundaries** of your research – plant groups studied, geographical focus, or biological processes explored.

III. Literature Review/Existing Knowledge:

Discuss the **existing research, practices, or data** related to your topic (e.g., traditional uses of medicinal plants, floristic

diversity, plant-pathogen interactions, etc.) and justify the need for your study.

IV. Materials and Methods / Operating Environment:

Detail the **materials (plant species, chemicals, tools)** and **methods used** (e.g., herbarium techniques, molecular analysis, ecological surveys, statistical tools, in silico modelling, etc.)

V. Methodology and System Description (If applicable):

For computational, database, or in silico studies:

- **Objectives** clearly defined.
- **User Requirements** (e.g., for plant identification apps or databases).
- **Methods** like data collection, taxonomic keys, GIS tools, or statistical software (e.g., R, Python).
- **System Features**, if a tool was developed, including:
 - Workflow diagrams
 - Data flow or process flow
 - Database structure
 - Input/output design
 - User interfaces

VI. Results and Discussion:

Present analysed data using **tables, graphs, charts, images**, and **discuss** botanical implications, significance, and comparisons with earlier work.

VII. Testing and Validation (If software model/tool is developed):

Explain testing procedures, result validation, and implementation feasibility.

VIII. Challenges and Limitations:

Discuss **problems faced** during the study and any **methodological or environmental limitations** encountered.

IX. Future Prospects / Proposed Enhancements:

Suggest **improvements** or future directions such as field expansion, molecular verification, or wider species sampling.

X. Conclusion:

	<p>Summarize major findings, their scientific contributions, and overall conclusion of the study.</p> <p>XI. Bibliography / References:</p> <p>List all references in proper scientific format (APA / Harvard / Vancouver).</p> <p>XII. Annexures:</p> <p>Include supplementary material such as:</p> <ul style="list-style-type: none"> • Field data sheets • Herbarium specimen details • Raw data tables • Questionnaire (if ethnobotanical survey conducted) • Maps, Photographs (if applicable) 	
KEYWORDS	Research Documentation, Literature Review, Scientific Communication, Data Analysis, Hypothesis Testing, Reference Management	
NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)		
 		

PART C – LEARNIG RESOURCES
TEXT BOOKS, REFERENCE BOOKS AND OTHERS
TEXT BOOKS RECOMMENDED
<ul style="list-style-type: none"> • Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications. • Galvan, J. L., & Galvan, M. C. (2017). Writing literature reviews: A guide for students of the social and behavioral sciences (7th ed.). Routledge. • Belcher, W. L. (2019). Writing your journal article in twelve weeks: A guide to academic publishing success (2nd ed.). University of Chicago Press. • Alley, M. (2013). The craft of scientific presentations: Critical steps to succeed and critical errors to avoid (2nd ed.). Springer. • Punch, K. F., & Oancea, A. (2014). Introduction to research methods in education (2nd ed.). SAGE Publications. • Field, A. (2018). Discovering statistics using IBM SPSS Statistics (5th ed.). SAGE Publications. • Ridley, D. (2012). The literature review: A step-by-step guide for students (2nd ed.). SAGE Publications.
REFERENCE BOOKS RECOMMENDED

- Walliman, N. (2017). Your research project: Designing and planning your work (4th ed.). SAGE Publications.
- Booth, W. C., Colomb, G. G., & Williams, J. M. (2016). The craft of research (4th ed.). University of Chicago Press.
- Turabian, K. L. (2018). A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers (9th ed.). University of Chicago Press.
- Rumsey, D. J. (2016). Statistics for dummies (2nd ed.). Wiley.
- Peat, J., Elliott, E., Baur, L., & Keena, V. (2002). Scientific writing: Easy when you know how. BMJ Books.
- Katz, M. J. (2009). From research to manuscript: A guide to scientific writing (2nd ed.). Springer.

ONLINE RESOURCES

- American Psychological Association. (2020). Academic writer. <https://academicwriter.apa.org/>
- Elsevier. Mendeley reference manager. <https://www.mendeley.com/>
- National Center for Biotechnology Information. PubMed. <https://pubmed.ncbi.nlm.nih.gov/>
- Google. Google Scholar. <https://scholar.google.com/>
- ResearchGate GmbH. ResearchGate. <https://www.researchgate.net/>
- Microsoft. Create a thesis or dissertation in Word. <https://support.microsoft.com/en-us/office/create-a-thesis-or-dissertation-in-word-1ae907b3-efda-40a1-b65c-49b84a8a5d50>
- Laerd Statistics. Statistical tutorials and software guides. <https://statistics.laerd.com/>

PART D – ASSESSMENT AND EVALUATION

SUGGESTED CONTINUOUS EVALUATION METHODS:

MAXIMUM MARKS: 600

CONTINUOUS INTERNAL ASSESSMENT (CIA) 180

END SEMESTER EXAM (ESE) 420

CONTINUOUS INTERNAL ASSESSMENT (CIA): 180 (By HoD)	INTERNAL TEST/QUIZ (2): 30 & 30 Assignment: 100 Synopsis presentation: 50 Total marks: 180	Better marks out of two test/quiz + obtained marks in + Assignment + Synopsis presentation shall be considered against 180 marks
END SEMESTER EXAM (ESE): 420	<ul style="list-style-type: none"> • Project Report/Dissertation work – 250 marks • Seminar – 100 marks • Viva voce – 70 marks 	Managed by HoD as per lab status

NAME AND SIGNATURE OF CONVENOR & MEMBERS (BOS)