

# PROGRAM STRUCTURE AND COURSE CURRICULUM

## B.Sc- Botany (4 Years Program)

*(According to CBCS & NEP 2020)*

**Syllabus as per the guidelines of State Higher Education Council**  
*(Partially modified: Board of Studies meeting on 23 May, 2025)*



**Department of Botany,**  
*Faculty of Science*  
*Siddharth University,*  
*Kapilvastu, Siddharthnagar, Uttar Pradesh*



**SIDDHARTH UNIVERSITY**  
**Kapilvastu, Siddharthnagar, Uttar Pradesh**

**SYLLABUS PROPOSED/DEVELOPED/REVISED**

**BY**

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**SIDDHARTH UNIVERSITY**  
**Kapilvastu, Siddharthnagar, Uttar Pradesh**

**B.Sc. Program Structure and Course Curriculum According to CBCS (NEP 2020)**  
**(Partially modified: Board of Studies meeting on 23<sup>rd</sup> May, 2025)**  
**Subject: Botany(UG)**

Year	Course Code	Paper Title	Theory/Practical	Credits
<b>First</b>	<b>Semester-I</b>			
	B040101T	Microbiology & Plant Pathology	Theory	04
	B040102P	Techniques in microbiology and plant Pathology	Practical	02
	<b>Semester-II</b>			
	B040201T	Archegoniates and Plant Architecture	Theory	04
	B040202P	Land Plants Architecture	Practical	02
<b>Exit 1: Certificate</b>				
<b>Second</b>	<b>Semester-III</b>			
	B040301T	Flowering Plants Identification and Aesthetic Characteristics	Theory	04
	B040302P	Plant identification Technology	Practical	02
	<b>Semester-IV</b>			
	B040401T	Economic Botany, Ethnomedicine and Phytochemistry	Theory	04
	B040402P	Commercial Botany and Phytochemical Analysis	Practical	02
<b>Exit 2: Diploma</b>				
<b>Third</b>	<b>Semester-V</b>			
	B040501T	Plant Physiology, Metabolism & Biochemistry	Theory	04
	B040502T	Molecular Biology & Bioinformatics	Theory	04
	B040503P	Experiments in Physiology, Biochemistry, Genetics, Molecular biology	Practical	02
	<b>Semester-VI</b>			
	B040601T	Cytogenetics, Plant breeding & Nanotechnology	Theory	04
<b>Fourth</b>	B040602T	Ecology & Environment	Theory	04
	B040603P	Lab on Cytogenetics, Biostatistics, Tissue Culture, Ecology, Soil science & Environment management	Practical	02
	<b>Exit 3: Degree in Bachelor of Science</b>			
Year	Course Code	Paper Title	Theory/Practical	Credits
<b>Fourth</b>	<b>Semester-VII&amp; VIII</b>			
	12 Months Apprenticeship/ Internship through NATS or from equivalent organization/ industry/ institute - ( 200 Hrs)			
	<b>Exit 4: Apprenticeship/ internship embedded B.Sc</b>			
	<b>Or</b>			
	<b>Semester-7</b>			

<b>Fourth</b>	BOUC401	Advance Microbiology and Plant Pathology	Theory	04
	BOUC402	Trends in Plant Sciences	Theory	04
	BOUC403	Techniques and Instrumentation	Theory	04
	BOUC404	Landscaping and Floriculture	Theory	04
	BOUP405	Practical (Based on BOUC401, 402,403)	Practical	04
	<b>Semester-8</b>			
	BOUC411	Research Methodology	Theory	04
	BOUC412	Environmental Awareness and Ethics	Theory	04
	BOUC413	Plant Systematics	Theory	04
	BOUC414	Conservation Biology	Theory	04
	BOUF415	Field visit, Report writing and Presentation	Field based course	04 (2+1+1)
	<b>Exit 4: 4 Year B.Sc (Honours )</b>			
	<b>Or (For students who secure 75% marks in the first 6 semesters)</b>			
<b>Fourth</b>	<b>Semester-7</b>			
	BOUC401	Advance Microbiology and Plant Pathology	Theory	04
	BOUC402	Trends in Plant Sciences	Theory	04
	BOUC403	Techniques and Instrumentation	Theory	04
	BOUP405	Practical (Based on BOUC401, 402,403)	Practical	04
	BOUP406	Research Project: Phase-I	Project	04
	<b>Semester-8</b>			
	BOUC411	Research Methodology	Theory	04
	BOUC412	Environmental Awareness and Ethics	Theory	04
	BOUC413	Plant Systematics	Theory	04
	BOUF415	Field visit, Report writing and Presentation	Field based course	04 (2+1+1)
	BOUP416	Research Project: Phase-II	Project	04
	<b>Exit 4: 4 Year B.Sc ( Honors with Research)</b>			

## **SUBJECT: BOTANY**

### **Subject prerequisites:**

To study Botany, a student must have had the subject Biology/Biotechnology learnt at 10+2 level.

### **COURSE INTRODUCTION**

The new curriculum of B.Sc. in Science (Botany) offers essential knowledge and technical skills to study plants in a holistic manner. Students would be trained in all areas of plant biology using unique combination of core, elective and vocational papers with significant inter-disciplinary components. Students would be exposed to cutting-edge technologies that are currently used in the study of plant life forms, their evolution and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of plants and their relevance to the national economy.

B.Sc. Botany program covers academic activities within the classroom sessions along with practical concepts at laboratory sessions. Infield, outstation activities and projects are also required to be organized for real-life experience and learning.

Candidates who have curiosity in plants kingdom, ecosystem, love exploring exotic places and wish to work as researchers or professions like Botanist, Conservationist, Ecologist, etc. can choose B.Sc. Botany course.

### **Program outcomes (POs):**

Transformed curriculum shall develop educated outcome-oriented candidature, fostered with discovery-learning, equipped with practice & skills to deal practical problems and versed with recent pedagogical trends in education including e-learning, flipped class and hybrid learning to develop into responsible citizen for nation-building and transforming the country towards the future with their knowledge gained in the field of plant science.

<b>PO 1</b>	CBCS syllabus with a combination of general and specialized education shall introduce the concepts of breadth and depth in learning
<b>PO 2</b>	Shall produce competent plant biologists who can employ and implement their gained knowledge in basic and applied aspects that will profoundly influence the prevailing paradigm of agriculture, industry, healthcare and environment to provide sustainable development.
<b>PO 3</b>	Will increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solution, improve practical skills, enhance communication skill, social interaction, increase awareness in judicious use of plant resources by recognizing the ethical value system.
<b>PO 4</b>	The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry along with graduate preparation for national as well as international competitive examinations, especially UGC-CSIR NET, UPSC Civil Services Examination, IFS, NSC, FCI, BSI, FRI etc.
<b>PO 5</b>	Certificate and diploma courses are framed to generate self- entrepreneurship and self-employability, if multi-exit option is opted.
<b>PO 6</b>	Lifelong learning be achieved by drawing attention to the vast world of knowledge of plants and their domestication.

**Programme specific outcomes (PSOs):*****B.Sc. I Year / Certificate course in Microbial Technology & Classical Botany***

This Programme imparts knowledge on various fields of plant biology through teaching, interactions and practical classes. It shall maintain a balance between the traditional botany and modern science for shifting it towards the frontier areas of plant sciences with applied approach. This syllabus has been drafted to enable the learners to prepare them for self-entrepreneurship and employment in various fields including academics as well as competitive exams. Students would gain wide knowledge in following aspects:

1. Diversity of plants and microbes their habitat, morphology, architecture and reproduction.
2. Plant disease causing microbes, symptoms & control.
3. Economic value of plants and their use in Human Welfare.

**Programme specific outcomes (PSOs):*****B.Sc. II Year/ (Diploma in Plant Identification, Utilization & Ethnomedicine)***

This course provides a broad understanding of identifying, growing and using plants. This course is primarily aimed to introduce people to the richness of plant diversity found in surrounding areas. Lecture sessions are designed to cover fundamental topics concerning classification of plants and their utilization required for understanding the flora and vegetation. Practical sessions are organized following theory for easy understanding of the various parts of the plants, structural organization of floral parts and diversity therein. Participants are taken to different locations covering a variety of habitats and forest types to acquaint them with the native flora. in the long run, will contribute towards building momentum for people's participation in environmental conservation without compromising on academic rigor and our rich wealth of knowledge inherited over generations.

1. The course will cover conventional topics in Field Botany like Evolutionary History & Diversity of Plants, Complete Morphology, Nomenclature of plants, Systems of Classification, Keys to Important Families of Flowering Plants, Field Data Collection & Herbarium Techniques.
2. The course is designed to become a commercial crop grower, florist, protected cultivator, green belt plant advisor to industries, pharmacologist & taxonomist.

**Programme specific outcomes (PSOs):*****B.Sc. III Year / Bachelor of Science***

The learning outcomes of three years graduation course are aligned with program learning outcomes but these are specific to-specific courses offered in a program. The core courses shall be the backbone of this framework whereas discipline electives, generic electives and skill enhancement courses would add academic excellence in the subject together with multi-dimensional and multidisciplinary approach.

1. Understanding of plant classification systematics, evolution, ecology, developmental biology, physiology, biochemistry, plant interactions with microbes and insects, morphology, anatomy, reproduction, genetics and molecular biology of various life-forms.
2. This course is suitable to produce expertise in conservation biology like ex-situ conservation, response to habitat change, genotype characterization and reproductive biology.
3. Understanding of various analytical techniques of plant sciences, use of plants as industrial resources or as human livelihood support system and is well versed with the use of transgenic technologies for basic and applied research in plants.

**4.** Understanding of various life forms of plants, morphology, anatomy, reproduction, genetics, microbiology, molecular biology, recombinant DNA technology, transgenic technology and use of bioinformatics tools and databases and the application of statistics to biological data.

**5.** Entrepreneurship Skill Development, Understand the issues of environmental contexts and sustainable development, Inculcation of human values,

**6.** Strengthen mathematical and computational skills. Enable students to use ICT&AI effectively.

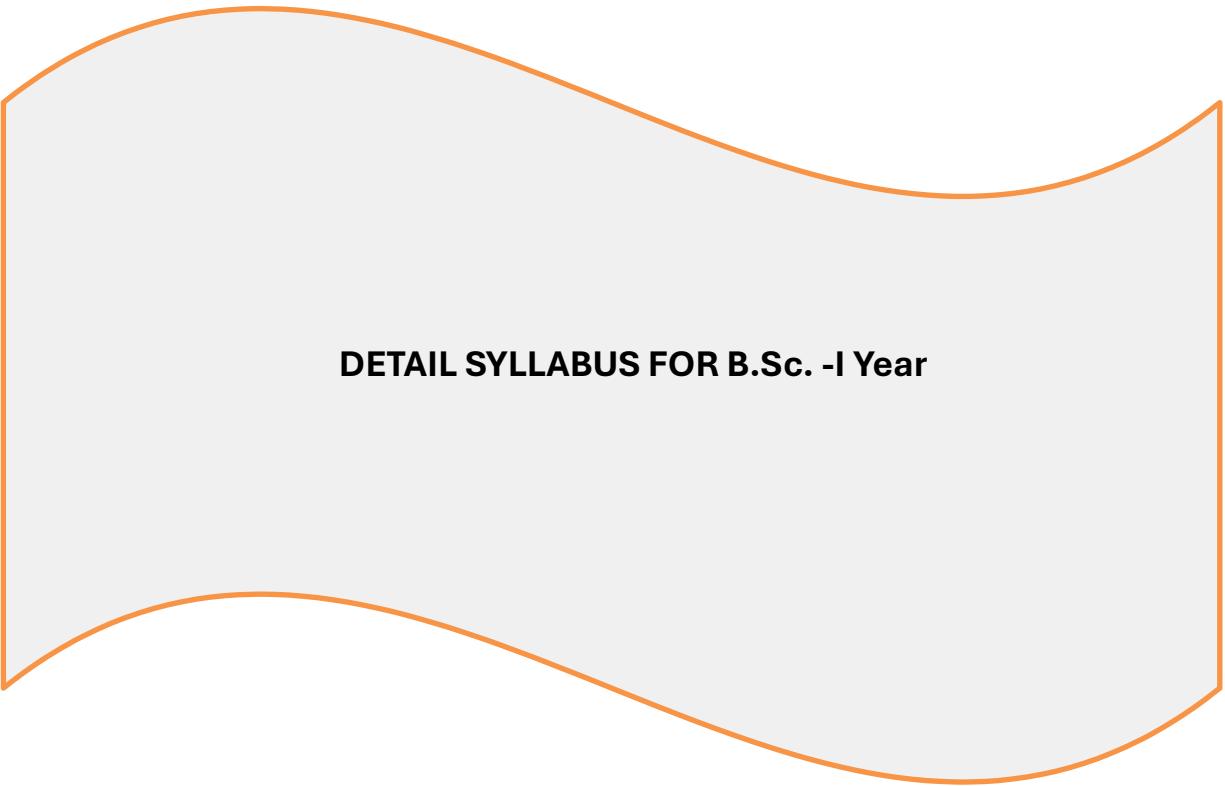
**7.** Develop good skills in laboratory such as observation and evaluation by the use of modern tools and technology.

<b>PSO 1</b>	Understanding the nature and basic concepts of all the plant groups, their metabolism, components at the molecular level, biochemistry, taxonomy and ecology. The course will make them aware of natural resources and environment and the importance of conserving it. Hands on training in various fields will develop practical skills, handling equipment's and laboratory use along with collection and interpretation of biological materials and data. Knowledge gained through theoretical and lab-based experiments will generate technical personnel in various priority areas such as genetics, cell and molecular biology, plant systematics and biotechnology.
<b>PSO 2</b>	Botanists are able to contribute to all these fields and therefore, are mainly employed with educational institutions, government or public sectors or companies in industries, such as agriculture or forestry, oil, chemical, biotechnology, geological survey, environmental protection, drugs, genetic research, plant resources laboratories, plant health inspection services, lumber and paper, food, fermentation, nursery, fruit and so on. Jobs available as a botanist: •Microbiologist, plant pathologist, Taxonomist • Plant Physiologist • Plant Biochemist • Researcher • Mycologist • Ecologist • Weed Scientist • Palaeobotanist • Conservationist • Fruit Grower • Morphologist • Cytologist • Ethnobotanist • Plant geneticists etc.
<b>PSO 3</b>	Inculcating strong fundamentals on modern and classical aspects of Botany, understanding knowledge of Botany is an essential pre-requisite for the pursuit of many applied sciences. It will facilitate students taking up and shaping a successful career in Botany and allied sciences.
<b>PSO 4</b>	Introduction of research project will inculcate research aptitude and passion for higher education and scientific research.

<b>Degree in Bachelor of Science (Apprenticeship/ internship embedded)</b>	
<b>B.Sc IV year Programme Specific Outcomes (PSOs)</b>	
<b>PSO1</b>	This program will equip students with the skills needed for the industry and provide opportunities to earn during their learning process.
<b>PSO2</b>	The program will provide exposure to students to learn new skills from the real world of academia, industry, administration etc.
<b>PSO3</b>	The Degree courses will enable students to go for higher studies like Masters (1 year's program) or Ph.D in Botany and allied subjects.

<b>4 Year B.Sc (Honours)</b>	
<b>B.Sc IV year Programme Specific Outcomes (PSOs)</b>	
<b>PSO1</b>	After completion of the program students have better knowledge about applied microbiology, and plant pathology. They will be able to understand new frontiers of plant science and well versed with modern instrumentation techniques which have industrial as well as academic implications. The knowledge of landscaping and floriculture helps them to create self-employment opportunities.
<b>PSO2</b>	Students having knowledge of environmental concerns, related ethics, importance of conservation and will contribute to achieving sustainable development goal of earth.
<b>PSO3</b>	After the completion of the program the students will be able to design and conduct field exploration tour. They know the methodologies of data collection, data analysis and how to present data. The skills mentioned will create job opportunities for them especially in departments related to forest, biodiversity etc.

<b>4 Year B.Sc (Honors with Research)</b>	
<b>B.Sc IV year Programme Specific Outcomes (PSOs)</b>	
<b>PSO1</b>	Students having knowledge of applied aspects of microbiology, plant pathology, plant systematics and instruments and techniques.
<b>PSO 2</b>	After the completion of the program the students will be able to design and conduct field exploration tour. They know the methodologies of data collection, data analysis and how to present data. The skills mentioned will create job opportunities for them, especially in departments related to forest, biodiversity etc.
<b>PSO 3</b>	Manpower with research skill and aptitude.
<b>PSO 4</b>	The Degree courses will enable students to go for higher studies like Masters (1 year's program) or Ph.D in Botany and Allied subjects.



## **DETAIL SYLLABUS FOR B.Sc. -I Year**



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Course for B.Sc. -I Semester (Botany)

#### Paper-I

**Course Title:** MICROBIOLOGY AND PLANT PATHOLOGY (UG Honors)

**Course Code:** B040101T

**Credit Units:** 4

**Level:** UG

**Course Objectives:** Gain knowledge about uses of

microbes in various fields such as mushroom cultivation and lichen application.

**Prerequisites:** Basic knowledge of Biology.

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Introduction to Ancient Indian Microbial Techniques &amp; Instrumentation</b>  Introduction to ancient Indian, Vedic, and heritage botany. Contribution of Indian botanists, in context with the holistic development of modern science and technology, must be taught, practiced, and assessed via class interaction/assignments/self-study mentioned under Continuous Internal Evaluation (CIE).  Microbial Techniques & Instrumentation: Microscopy—Light, phase contrast & electron microscopy, staining techniques for light microscopy, common equipment of microbiology labs (autoclave, oven, laminar air flow, centrifuge) and the principle of their working.	8
<b>Unit II: Microbial World</b>  Cell structure of eukaryotic and prokaryotic cell, Gram-positive and Gram-negative bacteria, Structure of a bacterium; Bacterial growth curve, Batch culture, Fed-batch culture, and Continuous culture; Sporulation, reproduction, and recombination in bacteria.  Viruses, general characteristics, structure of viruses, bacteriophages, structure of $\lambda$ -phage, lytic and lysogenic cycles, viroids, prions, mycoplasma & phytoplasma.	8
<b>Unit III: Phycology</b>  Range of thallus organization, pigments, reserve food, reproduction in algae. Economic importance of algae. Classification (Fritsch, F. E.) and life cycle of— <i>Scytonema</i> , <i>Nostoc</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Sargassum</i> , <i>Ectocarpus</i> , and <i>Batrachospermum</i> .	8
<b>Unit-IV: Mycology</b>  General characteristics, nutrition, life cycle and classification of fungi (Alexopoulos and Mims) up to class. Economic importance of fungi. Distinguishing characters of following genera.	8

Myxomycotina- <i>Physarum</i> ; Mastigomycotina- <i>Saprolegnia</i> ; Ascomycotina – <i>Penicillium</i> and <i>Peziza</i> ; Basidiomycotina- <i>Puccinia</i> and <i>Agaricus</i> ; Deuteromycotina – <i>Alternaria</i> . Mycotoxins, Heterothallism and Parasexuality.	
<b>Unit-V: Mushroom Cultivation, Lichenology &amp; Mycorrhiza</b>	<b>8</b>
Mushroom cultivation. General account of lichens, reproduction, and significance. Mycorrhiza and their significance.	
<b>Unit-VI: Plant Pathology</b>	<b>6</b>
Disease concepts, symptoms, etiology, and Koch's postulates. Mechanism of infection, disease cycle. Defense mechanisms with special reference to phytoalexin and fungicides.	
<b>Unit-VII: Diseases and Control</b>	<b>8</b>
Symptoms, causal organism, disease cycle, and control measures of early & late blight of potato, brown spot of rice, red rot of sugarcane, stem gall of coriander, yellow vein mosaic of bhindi, citrus canker, little leaf of brinjal. Disease management: Quarantine and Biological. Integrated pest and disease management.	
<b>Unit-VIII: Applied Microbiology</b>	<b>6</b>
Food fermentation and food produced by microbes, production of antibiotics and alcoholic beverages. Plant growth promoting rhizobacteria (PGPR) and biopesticides— <i>Trichoderma</i> and <i>Pseudomonas</i> , single-cell proteins, production of biofuels, biodegradation of pollutants. Biofertilizers and their mass production.	

**Course Outcomes:** Develop understanding about the classification and diversity of different microbes, including viruses, algae, fungi, lichens and their economic importance. Understand the structure and reproduction of certain selected bacteria, algae, fungi, and lichens.

#### **Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

#### **Assessment/Examination Scheme:**

The evaluation scheme and mode will be as per the guidelines notified by Siddharth University, Kapilvastu, Siddharth Nagar

#### **Textbooks/ References Books:**

##### **Course Books published in Hindi may be prescribed by the Universities.**

1. वनस्पति विज्ञान (संपूर्ण) शैवाल, कवक, लाइकेन, जीवाणु, विषाणु, ब्रायोफाइटा, टेरिडोफाइटा, जिम्बोस्पर्म तथा पुरा- वनस्पति विज्ञान : लेखक - सिंह, पांडे व जैन प्रकाशन: रस्तोगी प्रकाशन, मेरठ
2. सूक्ष्म जैविकी कवक एवं पादप रोग विज्ञान त्रिवेदी शर्मा एवं धनकर rbd publisher 2019
3. परिच्यात्मक पादप रोग विज्ञान डॉ आशीष कुमार त्रिपाठी डॉ सनत कुमार त्रिपाठी 2018 एग्रोबॉयोस इंडिया पब्लिशर
4. पादप रोग विज्ञान : जिया लाल यादव 2012
5. डॉ आशीष कुमार त्रिपाठी डॉ सनत कुमार त्रिपाठी 2018. परिच्यात्मक पादप रोग विज्ञान एग्रोबॉयोस इंडिया पब्लिशर
6. रीता वर्मा 2020. सूक्ष्म जैविकी, कवक एवं पादप रोग विज्ञान
7. प्रांजल आर्य 2020. पादप रोग: उत्पत्ति प्रसार एवं नियन्त्रण
8. Microbiology Fundamental And Applications (hindi) (pb)
9. ISBN : 9788188826230 Edition : 03 Year : 2016 Author : Dr. Purohit SS, Dr. Deo PPPublisher : Student Edition Language : Hindi
10. पादप रोग विज्ञान परिभाषा-कोश: Definitional Dictionary of Plant Pathology. Publisher Commission for Scientific and Technical Terminology.
11. Modern Microbiology (hindi) (hb) ISBN : 9788177543599 Edition : 1 Year : 2018 Author : Dr. Purohit SS, Dr. Singh T Publisher : Agrobios (India)

12. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
13. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
14. Aggarwal, S. K. 2009. Foundation Course in Biology, A one books Pvt. Ltd., New Delhi.
15. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
16. Basu, A. N. 1993. Essentials of Plant Viruses, Vectors and Plant diseases, New Age International, New Delhi.
17. Desikachari, T. V. 1959. Cyanophyta, ICAR, New Delhi.
18. Fritsch, R. E. 1977. Structure and Reproduction of Algae, Cambridge University Press, London.
19. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
20. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition. Singapore, Singapore: John Wiley & Sons.
21. Sethi, I.K. and Walia, S.K. (2011). Textbook of Fungi and Their Allies. Noida, U.P.: Macmillan Publishers India Ltd.
22. Sharma, P.D. (2011). Plant Pathology. Meerut, U.P.: Rastogi Publication.
23. Webster, J., Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge, U.K.: Cambridge University Press.
24. Pandey B.P. 2001. College Botany Volume 1, S Chand & Company Pvt. Ltd, New Delhi.
25. Pandey, B.P. 2014. Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
26. Pelzar, 1963. Microbiology, Tata Mc Graw Hill, New Delhi.
27. Sambamurty. A.V.S.S. 2006, A Textbook of Algae, I. K. International Publishing House, Pvt. Ltd., New Delhi.
28. Sharma, P. D. 2012, Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.
29. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
30. Smith, G. M. 1996. Cryptogamic Botany Volume I, Tata McGraw Hill, New Delhi.
31. Vashishta, B.R. Sinha, A.K. and Singh, V. P. 1991. Algae, S. Chand and Company, Pvt. Ltd., New Delhi.
32. David Moore, Geoffrey D. Robson, ,Anthony P. J. Trinci 2020.21st Century Guidebook to Fungi. Cambridge University Press.

<b><u>Record Matrix</u></b>	
<b><u>To be filled by the Institution</u></b>	
<b>Date of Introduction, of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt; 10%</b>



## SIDDHARTH UNIVERSITY

Kapilvastu, Siddharth Nagar (UP)- 272202

### Course for B.Sc.-I Semester (Botany) Paper-II Practical

**Course Title:** TECHNIQUES IN MICROBIOLOGY & PLANT PATHOLOGY (UG Honors)

**Course Code:** B040102P

**Credit Units:** 2

**Level:** UG

**Course Objectives:** Gain knowledge about uses of microbes in various fields.

**Prerequisites:** Basic knowledge of Biology.

#### Course Contents/Syllabus:

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	02

Descriptors/Topics (Minimum any 02 from each unit depending on facilities)	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Instruments &amp; Techniques</b>  1. Laboratory safety and good laboratory practices. 2. Principles and applications of laboratory instruments- microscope, incubator, autoclave, centrifuge, laminar air flow, filtration unit, shaker, and pH meter. 3. Cleaning and sterilization of glassware. 4. Preparation of nutrient media.	7
<b>Unit II: Bacterial Identification</b>  1. Isolation of bacteria. 2. Staining techniques: Gram staining. 3. Biochemical Characterization of bacteria; Urease test, nitrate reductase test, starch hydrolysis test, casein hydrolysis test.	8
<b>Unit III: Mycological Study</b>  1. Isolation of different fungi: Saprophytic, Coprophilous, Keratinophilic. 2. Identification of fungi by the lactophenol cotton blue method. <i>Rhizopus</i> , <i>Peziza</i> , <i>Saccharomyces</i> , <i>Penicillium</i> , <i>Ustilago</i> , <i>Puccinia</i> , <i>Fusarium</i> , <i>Curvularia</i> , and <i>Alternaria</i> . 3. <i>Agaricus</i> : Specimens of button stage and full-grown mushroom, sectioning through gills. 4. Lichens: crustose, foliose, and fruticose specimens.	8
<b>Unit IV: Phycology</b>  Study of thallus structure of following cyanobacteria and algae: <i>Microcystis</i> , <i>Spirulina</i> , <i>Nostoc</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Pinnularia</i> and <i>Sargassum</i> .	7
<b>Unit V: Experimental plant pathology</b>  1. Preparation of fungal media (PDA) and sterilization process.	8

2. Isolation of the pathogen from the diseased leaf. 3. Identification: Pathological specimens of the brown spot of rice, bacterial blight of rice, loose smut of wheat, stem rot of mustard, late blight of potato. 4. Slides of uredial, telial, pycnial and aecial stages of <i>Puccinia</i> , viral and bacterial plant diseases.	
<b>Unit VI: Applied microbiology-I</b>	<b>8</b>
1. Isolation of nitrogen-fixing bacteria from root nodules of legumes. 2. Enumeration of the rhizosphere to the non-rhizosphere population of bacteria. 3. Isolation of antagonistic <i>Pseudomonas</i> from soil. 4. Microscopic observations of root colonization by VAM fungi.	
<b>Unit VII: Applied microbiology-II</b>	<b>8</b>
1. Isolation of lactic acid bacteria from curd. 2. Isolation of lipolytic organisms from butter or cheese. 3. Isolation and characterization of acidophilic, alkalophilic, and halophilic bacteria.	
<b>Unit VIII: Industrial application</b>	<b>6</b>
1. Cultivation of <i>Spirulina</i> and <i>Chlorella</i> in laboratory for biofuel. 2. Visit to the biofertilizer and biopesticide unit to understand the Unit operation procedures. 3. Mushroom cultivation for protein. 4. Alcohol production from sugarcane juice. 5. Industrial and field visit.	

**Suggested Readings:**

**Course Books published in Hindi may be prescribed by the Universities.**

- प्रयोगात्मक वनस्पति विज्ञान भाग 1 लेखक अशोक बैंद्रे तथा अशोक कुमार प्रकाशन रस्तोगी प्रकाशन मेरठ
- प्रायोगिक वनस्पति विज्ञान-I Dhankar - Sharma – Trivedi ISBN Code: 978-81-8142-697-0 65, RBD Publishing House Shivaji Nagar Civil Lines, Jaipur - 302006 (Rajasthan)
- प्रायोगिक वनस्पति विज्ञान बी.एस-सी-1 एस बी अग्रवाल प्रकाशक : शिवलाल अग्रवाल एण्ड कम्पनी प्रकाशित वर्ष : 2018
- Practical Botany (Part I) ISBN #:81-301-0008-8 Sunil D Purohit, Gotam K Kukda & Anamika Singhvi Edition:2013 Apex Publishing House Durga Nursery Road, Udaipur, Rajasthan (bilingual)
- Modern Mushroom Cultivation And Recipes (hindi) (hb) ISBN : 9788177545180 Edition : 01 Year : 2017 Author : Singh Riti , Singh UCPublisher : Agrobios (India)
- Biofertilizer Production Manual (hindi) (hb) ISBN : 9788177541274 Edition : 01 Year : 2014 Author : Gehlot D Publisher : Agrobios (India) Language : Hindi
- Aneja, K. R. 1993. Experiments in Microbiology, Pathology, and Tissue Culture, Vishwa Prakashan, New Delhi.
- Dubey, R. C. and Maheshwari. D. K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
- Kodo, C.I., and Agarwal, H.O. 1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
- Madhavee Latha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi.
- Pandey, B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
- Sambamurti, A.V.S.S. 2006, A Text book of Algae, I. K. International Publishing House, Pvt. Ltd.,
- Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
- <https://agrimoon.com/wp-content/uploads/Mushroom-culture.pdf>
- <http://nhb.gov.in/pdf/Cultivation.pdf>
- [https://www.k-state.edu/fungi/Greeting/Publications\\_files/2006%20Handbook.pdf](https://www.k-state.edu/fungi/Greeting/Publications_files/2006%20Handbook.pdf)
- Sen, Surjit, Acharya, Krishnendu, Rai, Manjula 2019 ISBN - 978-93-88347-23-5 - Biofertilizers and Biopesticides .Technoworld, Kolkata

18. <http://www.kvkkendrapara.org/pdf/Bio%20Fertilizer%20Production%20and%20marketing.pdf>
19. <http://www.gbv.de/dms/tib-ub-hannover/751302945.pdf>
20. Hochman, Gal, and Zilberman, David. 2014. ISBN 1461493285— Algae Farming and Its Bio-Products Springer
21. Gokare A. Ravishankar, Ranga Rao Ambati. 2019. Handbook of Algal Technologies and Phytochemicals Volume II: Phycoremediation, Biofuels, and Global Biomass Production Print ISBN: 9780367178192
22. Amos Richmond, Ph.D., Prof. Emeritus, Qiang Hu Ph.D. 2013. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, Second Edition Print ISBN: 9780470673898.

<b><u>Record Matrix</u></b>	
<b><u>To be filled by the Institution</u></b>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt; 15%</b>



## SIDDHARTH UNIVERSITY

Kapilavastu, Siddharth Nagar (UP)- 272202

### Course for B.Sc.-II Semester (Botany)

#### Paper-I

**Course Title:** ARCHEGONIATES AND PLANT ARCHITECTURE (UG Honors)

**Course Code:** B040201T

**Credit Units:** 4

**Level:** UG

**Course Objectives:**

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

- To understand the morphology, anatomy and reproductive biology of archegoniate and higher plants.
- To introduce about basic concepts of palaeobotany.

**Prerequisites:** Basic knowledge of Biology.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Introduction to Archegoniates &amp; Bryophytes</b>	8
Study of silent features of archegoniates. General characteristics, classification of bryophytes (up to family; Proskauer,1957). Morphology, anatomy, and reproductive biology of <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , and <i>Sphagnum</i> . (Developmental details not to be included). Economic importance of bryophytes.	
<b>Unit II: Pteridophytes</b>	8
General characteristics, classification (up to family; by Bierhorst,1971) of pteridophytes. Morphology, anatomy, and reproductive biology of <i>Lycopodium</i> , <i>Selaginella</i> , <i>Equisetum</i> , and <i>Marsilea</i> (developmental details not to be included). Silent features of <i>Rhynia</i> (a fossil plant). Heterospory and seed habit, stelar evolution. Economic importance of pteridophytes.	
<b>Unit III: Gymnosperms</b>	8
Classification (Pant-1957) and distribution of gymnosperms. Morphology, anatomy, and reproductive biology of <i>Cycas</i> , <i>Pinus</i> , and <i>Ephedra</i> (developmental details not to be included). Economic importance of Gymnosperms.	
<b>Unit-IV: Palaeobotany</b>	6
Brief account of the process of fossilization, types of fossils, and study techniques, geological time scale, contribution of Birbal Sahni.	
<b>Unit-V: Angiosperm morphology (Stem, Roots, Leaves &amp; Flowers, Inflorescence)</b>	8
Morphology and modifications of roots, stems and leaves. Types of inflorescences, flower and flower parts, types of placentation and fruits.	
<b>Unit-VI: Plant Anatomy</b>	8

Meristematic and permanent tissues. Apical meristems and theories on apical organization-apical cell theory, histogen theory, and tunica-corpus theory. Secondary growth in root and stem. Annual growth rings, anomalous secondary growth in <i>Bignonia</i> , <i>Dracaena</i> , <i>Nyctanthus</i> .	
<b>Unit-VII: Reproductive Botany (Higher plants)</b>	<b>8</b>
Plant embryology: structure of microsporangium, microsporogenesis, structure of male gametophyte; structure of megasporangium and its types, megasporogenesis, structure and types of female gametophytes. Types of pollination, methods of pollination, fertilization, structure of dicot and monocot embryos. Double fertilization and endosperm.	
<b>Unit-VIII: Palynology</b>	<b>6</b>
Pollen morphology and structure. Applied aspects of palynology. Pollen allergy and palynology in forensic science.	

### Course Outcomes:

1. Develop critical understanding of morphology, anatomy, and reproduction of bryophytes, pteridophytes, and gymnosperms.
2. Understanding of plant evolution and their transition to land habitat.
3. Understand morphology, anatomy, reproduction, and developmental changes therein through typological study and create a knowledge base in understanding the basis of plant diversity, economic values and taxonomy of plants.

### Pedagogy for Course Delivery:

The course will be delivered in the form of lectures and discussions.

### Assessment/Examination Scheme:

The evaluation scheme and mode will be as per the guidelines notified by Siddharth University, Kapilvastu, Siddharth Nagar.

### Textbooks/Reference Books:

#### *Course Books published in Hindi may be prescribed by the Universities.*

1. वनस्पति विज्ञान (संपूर्ण) शैवाल, कवक, लाइकेन, जीवाणु, विषाणु, ब्रायोफाइटा, टेरिडोफाइटा, जिम्नोस्पर्म तथा पुरा- वनस्पति विज्ञान : लेखक - सिंह, पांडे व जैन प्रकाशन: रस्तोगी प्रकाशन, मेरठ
2. आवृत्तवीजी वनस्पति विज्ञान (टैक्सानॉमी, एनाटॉमी, एंट्रियोलॉजी तथा इकोनामिक बॉटनी) लेखक -सिंह, पांडे तथा जैन प्रकाशन :रस्तोगी प्रकाशन, मेरठ
3. नवीन परिचयात्मक वनस्पति विज्ञान डॉ एस के गुप्ता 2017 केदारनाथ रामनाथ पब्लिशर्स
4. ए.के. शर्मा & राजेश्वरी शर्मा 2018. वनस्पति विज्ञान वीएससी प्रथम भाग एसआर साइंटिफिक पब्लिशर्स
5. Gangulee, H. S. and K. Kar 1992. College Botany Vol. I and II. (New Central Book Agency)
6. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
7. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
8. Rashid A (1999) An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd. New

Delhi.

9. Sharma OP (1990) Textbook of Pteridophyta. MacMillan India Ltd. Delhi.
10. Vashishtha BR, Sinha AK, and Kumar A (2010) Botany for Degree Students – Pteridophyta, S. Chand and Company,
11. Vashishtha BR, Sinha AK, and Kumar A (2010) Botany for Degree Students
12. Parihar NS (1976) Biology and Morphology of Pteridophytes. Central Book Depot.
13. Bhatnagar SP (1996) Gymnosperms, New Age International Publisher.
14. Pandey BP (2010) College Botany Vol II S. Chand and Company, New Delhi
15. Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London
16. Bhattacharya et al. 2007. A textbook of palynology, Central, New Delhi.
17. Bhojwani, S.S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House.
18. P.K.K. Nair—A Textbook of Palynology.
19. Johri, B. M. 1984. Embryology of Angiosperms. Springer-Verlag, Berlin.
20. Dutta, A.C. 2016. Botany for Degree Students. Oxford University Press.
21. E.J. Eames. Morphology of Vascular Plants, Standard University Press.
22. Dickinson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
23. Fahn, A. (1974). Plant Anatomy. Pergamon Press, USA.

<b><u>Record Matrix</u></b>	
To be filled by Institution	
<b>Date of Introduction, of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt; 10%</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Course for B.Sc.-II Semester (Botany)**  
**Paper-II Practical**

**Course Title:** LAND PLANTS ARCHITECTURE (UG Honors)

**Course Code:** B040202P

**Credit Units:** 2

**Level:** UG

**Course Objectives:** To provide practical

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	02

knowledge to the students about architecture of archegoniate and flowering plants using various morphological, anatomical parameters etc.

**Prerequisites:** Basic knowledge of Biology.

**Course Contents/Syllabus:**

Descriptors/Topics (Minimum any 02 from each unit depending on facilities)	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Bryophytes</b>	8
<i>Riccia</i> and <i>Marchantia</i> -morphology of thallus, W.M. rhizoids and scales, V.S. thallus through Gemma cup, W.M. gemmae (all temporary slides), V.S. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides). <i>Pogonatum</i> morphology, W.M. leaf, permanent slides showing antheridial and archegonial heads, L.S. capsule.	
<b>Unit II: Pteridophytes</b>  <i>Selaginella</i> -Habit, rhizophore T. S., stem T. S. axis with strobilus, V. S. of strobilus, megasporophyll, and microsporophyll. <i>Equisetum</i> -Habit, rhizome, and stem T.S. and V.S. of strobilus. <i>Marsilea</i> -Habit, rhizome, and petiole T.S., V.S., and L.S. of Sporocarp. <i>Azolla</i> -Habitat and its Structure.	8
<b>Unit III: Gymnosperms</b>  <i>Cycas</i> -Seedling, coralloid root and coralloid root T. S., T. S. of leaflet and rachis, micro and mega sporophyll, male cone V. S., micro sporophyll T. S., entire and V. S. of ovule. <i>Pinus</i> —Branch of indefinite growth, spur shoot, T.S. of old stem and needle, R.L.S., and T.L.S. of stem, male and female cone, and V.S. of male and female cone. <i>Ephedra</i> and <i>Thuja</i> : Habit, stem T.S. (young and mature), leaf T. S., male and female strobilus, V. S. of male and female cone, ovule V. S., and seed.	8
<b>Unit IV: Palaeobotany &amp; Palynology</b>  1. Morphology of <i>Rhynia</i> (virtual) and fossils, gymnosperms and other groups. 2. Visit to Birbal Sahni Institute of Paleosciences or a virtual conference with their scientists to learn fossilization. 3. Mark and know about Indian geographical sites rich in plant fossils.	6

<b>Unit V: Angiosperm Morphology</b>	<b>8</b>
<ol style="list-style-type: none"> <li>1. Study of diversity in leaf shape, size, and other foliar features.</li> <li>2. Modifications in roots, stems, leaves, and inflorescences.</li> <li>3. Study of monopodial and sympodial branching.</li> <li>4. Study of different types of fruits.</li> <li>5. Study of inflorescence types (study from fresh/preserved specimens).</li> <li>6. Study of flower characteristics (study from fresh/preserved specimens).</li> <li>7. Study of different types of ovules (permanent slides/specimens/photographs).</li> </ol>	
<b>Unit VI: Plant Anatomy</b>	<b>8</b>
<ol style="list-style-type: none"> <li>1. Study of primary and secondary growth in roots and stems of monocots and dicots by section cutting and permanent slides.</li> <li>2. Study of the internal structure of dicot and monocot leaves. Study of the structure of stomata.</li> <li>3. Normal and anomalous secondary characters in <i>Bignonia</i>, <i>Dracaena</i>, <i>Boerhaavia</i> and <i>Nyctanthus</i>.</li> </ol>	
<b>Unit VII: Reproductive Botany</b>	<b>7</b>
<ol style="list-style-type: none"> <li>1. Structure of anther, microsporogenesis, and pollen grains</li> <li>2. Structure of ovules and embryo sac development (through slides).</li> <li>3. Study of embryo development in monocots and dicots.</li> <li>4. Study of seed germination.</li> <li>5. Study of pollen morphology of the following plants—<i>Hibiscus</i>, <i>Vinca</i>, <i>Balsam</i>, <i>Ixora</i>, <i>Crotalaria</i>, and <i>Bougainvillea</i> by microscopic observation.</li> <li>6. Calculation of pollen viability percentage using <i>in vitro</i> pollen germination techniques.</li> </ol>	
<b>Unit VIII: Commercial uses and production Technology</b>	<b>7</b>
<ol style="list-style-type: none"> <li>1. Azolla production.</li> <li>2. Production and propagation of ornamental <i>Pteris</i>, Cycadales, and Coniferales for landscaping.</li> </ol>	

**Suggested Readings:**

**Course Books published in Hindi may be prescribed by the Universities.**

प्रयोगात्मक वनस्पति विज्ञान भाग 1,II लेखक अशोक बेंद्रे तथा अशोक कुमार प्रकाशन रस्तोगी प्रकाशन मेरठ

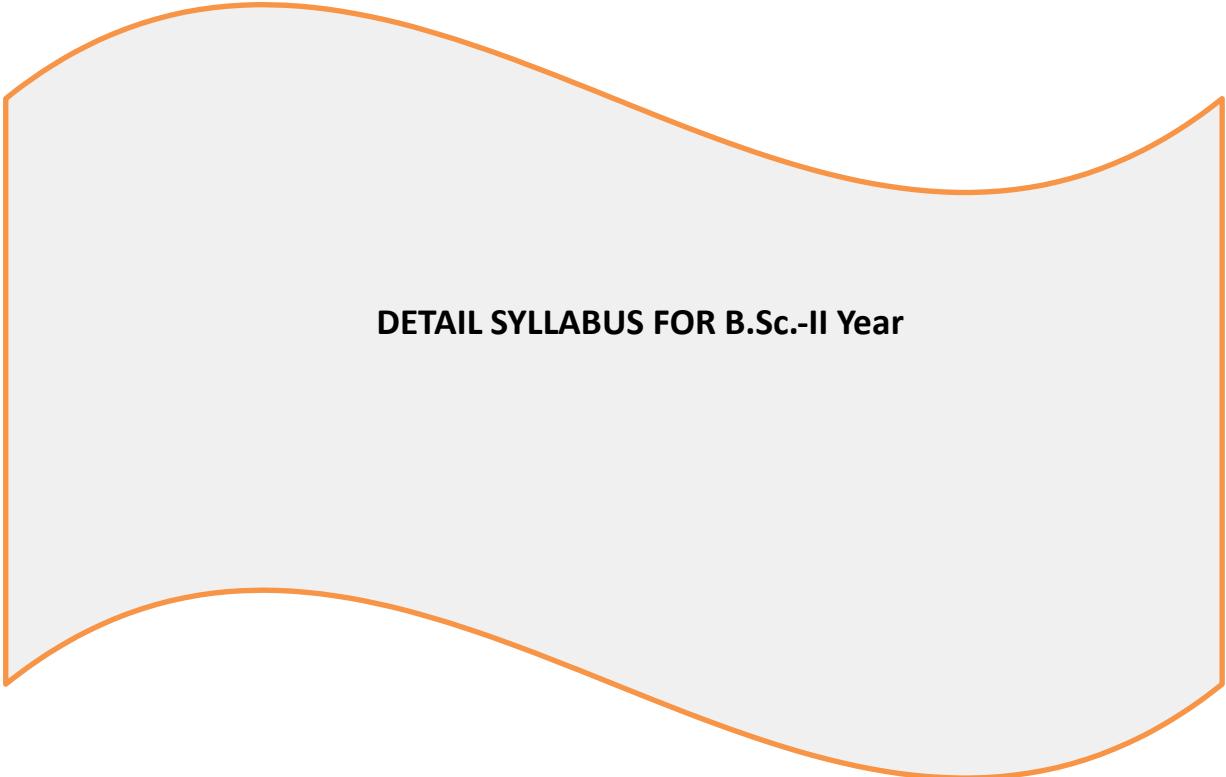
प्रायोगिक वनस्पति विज्ञान भाग I, II, III त्रिवेदी शर्मा बोहरा और धनखड़

प्रयोगात्मक वनस्पति विज्ञान भाग 2 लेखक :अशोक बेंद्रे तथा अशोक कुमार प्रकाशन :रस्तोगी प्रकाशन, मेरठ

प्रायोगिक वनस्पति विज्ञान वी.एस-सी-।,॥ एस वी अग्रवाल प्रकाशक : शिवलाल अग्रवाल एण्ड कम्पनी

1. P.S. 1997. Botany Vol. I (10th edition). Vikas Publishing House.
2. Pandey, BP; Misra; Trivedi, P.S. 1997. Botany Vol. II. Vikas Publishing House.
3. Pandey, BP and Chadha. 1997. Botany Vol. III. Vikas Publishing House.
4. Santra, SC and Chatterjee. 2005. College Botany Practical Vol. I. New Central Book Agency (P) Ltd.
5. Kumar, S and Kashyap. 2003. Manual of Practical Algae. Campus Books International, New DelhiBendre and Kumar A text book of Practical Botany. Vol I, II., Rastogi Pub. Meerut.
6. Suresh Kumar, Amar Singh Kashyap Manual of Practical Algae. Campus Books Internet, New Delhi.
7. Santra, SC. 2005. College Botany Practical Vol. II. New Central Book Agency (P) Ltd.

<b><u>Record Matrix</u></b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt; 15 %</b>



## **DETAIL SYLLABUS FOR B.Sc.-II Year**



## SIDDHARTH UNIVERSITY

Kapilvastu, Siddharth Nagar (UP)- 272202

### Course for B.Sc.-III Semester (Botany)

#### Paper-I

**Course Title:** FLOWERING PLANTS IDENTIFICATION & AESTHETIC CHARACTERISTICS (UG Honors)

**Course Code:** B040301T

**Credit Units:** 4

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants.

**Pre-requisites:** Basic knowledge of Biology.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Taxonomic Resources &amp; Nomenclature</b>  Components of taxonomy (identification, nomenclature, classification); Taxonomic resources: Herbarium- functions and important herbaria, botanical gardens, flora. Botanical Nomenclature- Principles and rules of ICN.	<b>8</b>
<b>Unit II: Types of classification &amp; Evidences</b>  Artificial, natural, and phylogenetic. Bentham and Hooker (up to series), Taxonomic evidence from palynology, cytology, phytochemistry, and molecular biology data.	<b>8</b>
<b>Unit III: Identification of Angiospermic families -I</b>  A study of the following families with emphasis on the morphological peculiarities and economic importance of their members (based on Bentham and Hooker's system)- Ranunculaceae, Malvaceae, Fabaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadiaceae, Solanaceae.	<b>8</b>
<b>Unit-IV: Identification of Angiospermic families -II</b>  A study of the following families with emphasis on the morphological peculiarities and economic importance of their members (based on Bentham and Hooker's system)- Amaranthaceae, Euphorbiaceae,	<b>8</b>

Papaveraceae Orchidaceae, Liliaceae, Poaceae.	
<b>Unit-V: Modern trends in Plant taxonomy</b>	<b>8</b>
Phenetics and Cladistics: Brief idea on Phenetics, Numerical taxonomy-methods, Operational Taxonomic Units, Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic, and paraphyletic groups.	
<b>Unit-VI: Tools &amp; Software in Plant Identification</b>	<b>6</b>
GIS Mapping (i) Patterns (ii) Features (iii) Quantities. GPS Free Phylogenetic Software. Digital Taxonomy, Description Language for Taxonomy- DELTA	
<b>Unit-VII: Computer Applications</b>	<b>7</b>
Introduction to Computers – classification, computer generation, software and hardware, operating systems, characteristics and applications, computer memory and its types, data storage. Microsoft Excel, data entry, graphs, formulas, and functions.	
<b>Unit-VIII: Aesthetic Characteristics of Plants</b>	<b>7</b>
Aesthetic characteristics of plants, English, Italian, Mughal, and Japanese gardens; Features of a garden. Some Famous gardens of India. Conservatory, Greenhouse, Indoor Garden, Roof Garden, Bonsai.	

**Course Outcomes:** After the completion of the course, the student will be able:

1. To gain an understanding of the history and concepts underlying various approaches to plant taxonomy and classification.
2. To compare the different approaches to classification about the analysis of data.
3. To use diverse taxonomic resources, reference materials, and herbarium collections, and publications.

#### **Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

#### **Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar

## Textbooks/ Reference Books:

### ***Course Books published in Hindi may be prescribed by the Universities.***

1. आवृत्तवीजी वनस्पति विज्ञान (टैक्सानॉमी ,एनाटॉमी ,एंट्रियोलॉजी तथा इकोनामिक वॉटनी) लेखक -सिंह, पांडे तथा जैन प्रकाशन :रस्तोगी प्रकाशन, मेरठ
2. भारत की संपदा,विज्ञान संचार भवन ड्र. क.स. कृष्णन मार्ग पूसा कॅपस
3. Propagation And Nursery Management (hindi) (hb) ISBN : 9788177546200 Edition : 01 Year : 2016 Author : Pandey S.K. , Soni N. Publisher : Agrobios (India)
4. Dr. Amar Singh. पादपवर्गिकी- Plant Taxonomy (An Old and Rare Book) from the category Ayurveda in our Books collection. Uttar Pradesh Hindi Sansthan, Lucknow
5. Bole, P. V. and Vaghani, Y. (1986) Field guide to the common trees of India. Oxford University Press; Bombay.
6. Brandis, D. (1906) Indian Trees (London, 5th edition. 1971). International Book Distributors; Dehra Dun.
7. Dallwitz, M. J., Paine, T. A. and Zurcher, E. J. (2003). Principles of interactive keys. <http://delta-intkey.com>
8. <https://www.naace.co.uk/school-improvement/ict-mark/>
9. <https://www.socitm.gov.uk>, (2002) Learning in the 21st century Executive briefing A Socitm Insight publication, July 2002 Socitm.
10. K. B. Anjaria, (2015) “Electronic Herbarium and Digital Database Preparation of Common Trees of Anand District, Gujarat” MRP submitted to UGC, WRO, Pune 2015 (unpublished)
11. Lizeron Eremias and R. Subash. (2013) “E-Content Development: A Milestone In The Dynamic Progress Of E- Learning” International Journal of Teacher Educational Research (IJTER) Vol.2 No.1 January, 2013 ISSN: 2319- 4642
12. Pandey, B.P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd, New Delhi.
13. Stace, C. A. 1989. Plant Taxonomy and Biostatistics (2nd Ed.). Edward Arnold, London.
14. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
15. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
16. Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
17. Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
18. Austin, R. 2002. Elements of planting design. New York: John Wiley & Sons.
19. Bertauski, T. 2005. Designing the landscape: An introductory guide for the landscape designer. Upper Saddle River, NJ: Pearson Prentice Hall.

20. Thomas, H., and S. Wooster. 2008. The complete planting design course: Plans and styles for every garden. London: Octopus Publishing Group.

21. Scarfone, S. 2007. Professional planting design: An architectural and horticultural approach for creating mixed bed plantings. New York: John Wiley & Sons.

22. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

<b><u>Record Matrix</u></b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not Applicable</b>



## SIDDHARTH UNIVERSITY

Kapilvastu, Siddharth Nagar (UP)- 272202

### Course for B.Sc.-III Semester (Botany)

#### Paper-II Practical

**Course Title:** PLANT IDENTIFICATION TECHNOLOGY (UG Honors)

**Course Code:** B040302P

**Credit Units:** 2

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	02

**Course Objectives:** To learn how plant specimens are collected, documented, and curated for a permanent record.

**Pre-requisites:** Basic knowledge of Biology.

#### **Course Contents/Syllabus:**

<b>Descriptors/Topics</b> (Perform any three experiments from each unit as per facility)	<b>Total no. of lectures/Teaching Hours (60)</b>
<b>Unit I: Herbarium: Plant Collecting, Preservation, and Documentation</b>	7
Stepwise Practicing Herbarium techniques: a. Field equipment, Global Positioning System (GPS) instrument, and Collection of any wild 25 plant specimens b. Learn to handle Herbarium making tools c. Pressing and drying of collected plant specimens d. Special treatments for all the varied groups of plants e. Mount on standard herbarium sheets f. Label using the Standard method g. Organize them and give the Index Register Number	
<b>Unit II: Taxonomic Identification using plant structure</b>	8
Classify 25 plants based on Taxonomic description (Plant Morphology, Anatomy, Reproductive parts, Habit, adaptation anomalies) according to Bentham and Hooker's system of classification in the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiate (Lamiaceae), Rubiaceae.	
<b>Unit III: Identification during excursions</b>	8
a. Conducting Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided) and making a field notebook, and filling Sample of a page of the field-book, used in the Botanical Survey of India. b. Describe/compare flowers in semi-technical language, giving V.S. of flowers, T.S. of ovaries, floral diagrams, and Floral Formulae. Identify and assign them to their respective families,	

giving reasons.	
<b>Unit IV:</b>	7
Collection, Preservation, and Storage of Algae, Fungi, Bryophytes, Pteridophytes (Two Each)	
<b>Unit V: Botanical Nomenclature &amp; Reporting Method</b>	7
a. Give nomenclature to collected plants as per ICBN rules and prepare labels as per BSI b. Author Citation, Effective Publication, and Principle of Priority: To show a specimen paper on the basic structure of a taxonomic Research published on a new species in a taxonomic journal	
<b>Unit VI: Computers</b>	7
1. Learning to use EXCEL, Microsoft PowerPoint, and Word, working with folders and Windows Utility, Create and Manage Files and Folder Tree. 2. Practice browsing of different sites using a search engine. practice and understand different email services – Outlook, Yahoo Mail, Rediff Mail, etc. Practice Creating E-Mail accounts, Sending, Receiving & Storing of emails. 3. Create and participate in a virtual conference in an interactive Zoom Meeting. Normal & Anomalous secondary thickening - Bignonia, Dracaena, Boerhaavia, Nyctanthus 4. Study of primary and secondary growth in roots and stems of monocots and dicots by section cutting and permanent slides. 5. Study of the internal structure of dicot and monocot leaves. Study of the structure of stomata.	
<b>Unit VII: Computer Application in Taxonomy</b>	8
1. Use Taxonomic Software's (Dichotomous Key) 2. Practical's on Phylogenetic analysis 3. Make a line drawing of Plants for description 4. Using plant identification apps on Android phones	
<b>Unit VIII:</b>	8
1. Create a Bonsai of any plant 2. Develop a miniature garden 3. Draw Layouts of various types of gardens 4. Plant Propagation Methods Practice	

#### **Textbook/Reference book:**

1. Day, S.C. (2003) Complete Home Gardening. (2003) Agrobios, Jodhpur, India.
2. Dhopte, A.M. (2003) Principles and Techniques for Plant Scientists. - Agrobios, Jodhpur, India.
3. Pramila Mehra Gardening for every one-. Hind pocket book private limited, New Delhi.
4. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
5. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
6. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

7. Bole, P. V. and Vaghani, Y. (1986) Field guide to the common trees of India. Oxford University Press; Bombay.
8. Womersley, J. S. 1981. Plant collecting and herbarium development: A manual.
9. Brandis, D. (1906) Indian Trees (London, 5th edition. 1971). International Book Distributors; Dehradun.
10. Dallwitz, M. J., Paine, T. A. and Zurcher, E. J. (2003). Principles of interactive keys. <http://deltaintkey.co> <https://www.naace.co.uk/school-improvement/ict-mark/>
11. Manilal, K. S. and M. S. Muktesh Kumar (ed.) (1998) A Hand book of Taxonomy Training, DST, N.Delhi
12. Primak, R. B. (2004) A Primer of Conservation Biology. Sinauer Associales, Inc. Publishers
13. Quicke, Donald, L. J. (1993) Principles and Techniques of Commemorative Taxonomy. Blakie, Academic and Professional, London
14. Singh, G (2004) Plant Systematics: Theory and practice Oxford and YBH Publishing Co. Pvt. Ltd., New Delhi.
15. Bridson, D. & L. Forman. eds. 1998. The Herbarium Handbook. 3rd ed. Royal Botanic Gardens, Kew (Reprinted 1999).
16. De Vogel, E.F. 1987. Manual of Herbarium Taxonomy: Theory and Practice. UNESCO, Jakarta.
17. Fosberg, F.R. & M.-H. Sachet. 1965. Manual for tropical herbaria. Int. Bur. Pl. Tax. & Nom. Regnum Vegetable Vol. 39. Utrecht.
18. Jain, S.K. & R.R. Rao. 1977. A handbook of field and herbarium methods. Today & Tomorrow's Printers and Publishers, New Delhi.
19. Victor, J.E., M. Koekemoer, L. Fish, S.J. Smithies, M. Mossmer. 2004. Herbarium essentials.

<b><u>Record Matrix</u></b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025 (Proposed)</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable</b>



## SIDDHARTH UNIVERSITY

Kapilvastu, Siddharth Nagar (UP)- 272202

### Course for B.Sc.-IV Semester (Botany)

#### Paper-I

**Course Title:** ECONOMIC BOTANY, ETHNOMEDICINE AND PHYTOCHEMISTRY (UG Honors)

**Course Code:** B040401T

**Credit Units:** 4

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Level:** UG

**Course Objectives:** Understand phytochemical analysis related to medicinally important plants and economic products produced by the plants

**Pre-requisites:** Basic knowledge of Biology.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Origin and domestication of cultivated plants</b>	7
Centers of diversity of plants. Domestication and introduction of crop plants. cultivation, production, and uses of Cereals, legumes, and Spices.	
<b>Unit II: Botany of oils, Fibers, timber-yielding plants &amp; dyes</b>	7
Study of the plants with Botanical names, Family, part used, and economic uses yielding Edible and essential oils; Sugar, Fibers; Rubber, Dyes, Timber, biofuel crops.	
<b>Unit III: Commercial production of Flowers, Vegetables, and Fruits (To be chosen area-wise)</b>	7
Commercial greenhouse cultivation of rose, Gladiolus, bell pepper, strawberry, & Exotic leafy vegetables using Hydroponics.	
<b>Unit-IV: IPR &amp; Traditional Knowledge</b>	8
IPR and WTO (TRIPS, WIPO), Patent Act 1970 and its amendments, Procedure of obtaining patents, Working of patents, Infringement, Copyrights, Trademarks, Geographical Indications, Traditional Knowledge, and Digital Library.	

<b>Unit-V: Ethnobotany</b>	<b>8</b>
Methodologies of ethnobotanical research: Field work, Literature, Herbaria, and Museum. Importance of ethnobotany in Indian systems of medicine (Siddha, Ayurveda, and Unani), Role of AYUSH, NMPB, CIMAP, and CARI.	
<b>Unit-VI: Medicinal aspects</b>	<b>8</b>
Study of common plants used by tribes ( <i>Aegle marmelos</i> , <i>Ficus religiosa</i> , <i>Cynodon dactylon</i> , <i>Eclipta alba</i> , <i>Oxalis</i> , and <i>Ocimum sanctum</i> ) Preservation of primeval forests in the form of sacred groves of individual species. Plants in primary health care: common medicinal plants: <i>Tinospora</i> , <i>Acorus</i> , <i>Ocimum</i> , <i>Turmeric</i> , and <i>Aloe</i> .	
<b>Unit-VII: Pharmacognosy</b>	<b>8</b>
Classification of drug plants based on sources of crude drugs – roots, rhizome, bulb, corm, leaves, stems, flowers, fruits, and seeds. Organoleptic study of <i>Adhatoda vasica</i> , <i>Andrographis paniculata</i> , <i>Azadirachta indica</i> , <i>Coriandrum sativum</i> , <i>Eclipta alba</i> , <i>Emblica officinalis</i> , <i>Ocimum sanctum</i> , <i>Ricinus communis</i> , <i>Vinca rosea</i> , and <i>Zingiber officinale</i> . Drug adulteration.	
<b>Unit-VIII: Herbal Preparations &amp; Phytochemistry</b>	<b>7</b>
Collection of wild herbs -Capsules- compresses. Hydrotherapy or Herbal bath - Herbal oils - Liquid extracts or Tincture - Poultices - Salves - Teas. <i>Anthocyanins</i> and <i>Coumarins</i> and therapeutic applications, Lignans, Terpenes, Volatile oils and Saponins, Carotenoids and Alkaloids, and pharmacological activities.	

**Course Outcomes:** 1. Understand the uses of plants –will know one plant-one employment.

2. Know about the importance of Medicinal plants and their useful parts, economically important plants in our daily life, and about the traditional medicines and herbs, and their relevance in modern times.

#### **Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

#### **Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar

## **Textbooks/ References Books:**

### ***Course Books published in Hindi may be prescribed by the Universities.***

1. आवृत्तबीजी वनस्पति विज्ञान (टैक्सानांमी, एनाटांमी, एंट्रियोलॉजी तथा इकोनामिक बॉटनी) लेखक -सिंह, पांडे तथा जैन प्रकाशन :रस्तोगी प्रकाशन, मेरठ
2. भारत की संपदा, विज्ञान संचार भवन इ. क.स. कृष्णन मार्ग पूसा कॅपस
3. पारिस्थितिकी एवं आर्थिक वनस्पति विज्ञान - Dhankar - Sharma – Trivedi
4. Aushdhiye Poudhe (Hindi) by R.P. Sharma | 1 January 2013 YKING BOOKS
5. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
6. Sambamurthy, AVSS & Subrahmanyam, NS (2000). Economic Botany of Crop Plants. Asiatech Publishers. New Delhi.
7. Singh, D.K and K.V. Peter. 2014. Protected cultivation of horticultural crops. New India Publishing Agency, India.
8. Reddy P. Parvatha. 2016. Sustainable crop protection under protected cultivation. Springer, Singapore.
9. Amit Deogirikar. 2019. A Text Book on Protected Cultivation and Secondary Agriculture. Raj Laxmi Prakashan, Aurangabad, India.
10. Singh, B., B. Singh, N. Sabir and M Hasan. 2014. Advances in protected cultivation. New India Publishing Agency, India.
11. Sharma, OP. 1996. Hill's Economic Botany (Late Dr. AF Hill, adopted by OP Sharma). Tata McGraw-Hill Co. Ltd., New Delhi.
12. Joe J. Hanan. 1997. Greenhouses: Advanced Technology for protected horticulture. CRC Press.
13. Krishnamurthy, K.V. (2004). An Advanced Text book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
14. N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001).
15. Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications(2003).
16. P. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw Hill (2001).
17. Arthur Raphael Miller, Micheal H. Davis; Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, WestGroup Publishers (2000).
18. Jayashree Watal, Intellectual property rights in the WTO and developing countries, Oxford University Press, Oxford.
19. Jain, S. K. and V. Mudgal. 1999. A Handbook of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun.
20. Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
21. Joshi, S. G. 2000. Medicinal Plants. Oxford and IBH, New Delhi.
22. Kokate, C. and Gokeale- Pharmacognosy- Nirali Prakashan, New Delhi.

23. Lad, V. 1984. Ayurveda – The Science of Self-healing. Motilal Banaras Dass, New Delhi.

24. Lewis, W. H. and M. P. F. Elwin Lewis. 1976. Medical Botany. Plants Affecting Man's Health. Aa. Wiley Inter science Publication. John Wiley and Sons, New York.

25. Farooqui, A. A. and Sreeraman, B. S. 2001. Cultivation of medicinal and aromatic crops. Universities Press.

26. Harborne, J. B. 1998. Phytochemical methods – a guide to modern techniques of plant analysis 3 rd. edition, Chapmanand Hall.

27. Yesodha, D., Geetha, S and Radhakrishnan, V. 1997. Allied Biochemistry. Morgan publications, Chennai.1. GurdeepChatwal, 1980. Organic chemistry of natural products. Vol. I. Himalaya Publishing house.

28. Kalsi, P. S. and Jagtap, S., 2012. Pharmaceutical medicinal and natural product chemistry. N.K. Mehra for Narosa Publishing House Pvt. Ltd. New Delhi.

29. Wallis, T. E. 1946. Text book of Pharmacognosy, J & A Churchill Ltd.

30. Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.

31. Jain S. K. 1989. Methods and approaches in Ethnobotany, Society of Ethnobotanists, Lucknow.

32. Sharol Tilgner, N. D. 1999. Herbal medicine - From the heart of the earth. Edn. 1, Printed in the USA by Malloy Lithographing Inc.

33. Pal, D.C. & Jain, S.K., 1998. Tribal Medicine. Naya Prakash Publishers, Calcutta.

34. Datta & Mukerji, 1952. Pharmacognosy of Indian roots of Rhizomes drugs. Bulletin No.1 Ministry of Health, Govt. of India.

35. Young Ken, H.W., 1948. Text Book of Pharmacognosy. Blakiston C., Philadelphia.

36. Shukla, R.S., 2000. Forestry for tribal development. A.H. Wheeler & Co. Ltd., India.

37. Raychudhuri, S.P., 1991. (Ed.) Recent advances in Medicinal aromatic and spice crops. Vol.1, Today&Tomorrow's printers and publishers, New Delhi.

38. Bajpai, P.K. 2006. Biological Instrumentation and methodology. S. Chand & Co. Ltd.

39. K. Wilson and J. Walker Eds. 2005. Biochemistry and Molecular Biology. Cambridge University Press.

40. k. Wilson and KH Goulding. 1986. Principles and techniques of Practical Biochemistry. (3rd edn. EdwardArnold, London.

<b><u>Record Matrix</u></b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025 (Proposed)</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



# SIDDHARTH UNIVERSITY

## Kapilvastu, Siddharth Nagar (UP)- 272202

### Course for B.Sc.-IV Semester (Botany)

#### Paper-II Practical

**Course Title:** COMMERCIAL BOTANY & PHYTOCHEMICAL ANALYSIS (UG Honors)

**Course Code:** B040202P

**Credit Units:** 2

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	02

**Course Objectives:** Gain the knowledge about cultivation practices of some economic crops.

**Pre-requisites:** Basic knowledge of Botany

#### **Course Contents/Syllabus:**

Descriptors/Topics  (perform minimum any three experiments from each unit)	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Economic Botany &amp; Micro techniques</b>	<b>8</b>
1. Cereals: Wheat (habit sketch, L.S./T.S. of grain, starch grains, micro-chemical tests); rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests) Legume: Pea or ground nut (habit, fruit, seed structure, micro-chemical tests) 2. Source of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests); potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, W.M. of starch grains, micro-chemical tests). 3. Tea- tea leaves, tests for tannin 4. Mustard- plant specimen, seeds, tests for fat in crushed seeds. Timbers: a section of young stem. 5. Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem, and study of fiber following maceration technique. 6. Study of specimens of economic importance mentioned in Unit I & II	
<b>Unit II: Commercial Cultivation</b>	<b>8</b>

1. Field visit to greenhouses for understanding Floriculture and vegetables production, Development of hydroponics nutrient solutions, and running models for the cultivation of vegetables. 2. Development of hydroponics nutrient solutions and running models for the cultivation of fodder	
<b>Unit III: Cultivating Medicinal and aromatic plants &amp; Essential oil extraction</b>	7
Lemon grass/ Neem/ Zinger /Rose/Mint	
<b>Unit IV: Documentation from Traditional Knowledge Digital Library</b>	7
1. Mark the Geographic Indications on the Map, understand –Nakshatra Vatika, Navgrah Vatika, and develop in your college 2. To extract the names of the plants and Botanical uses depicted in our epics. Visit NISCAIR, New Delhi	
<b>Unit V: Ethnobotany</b>	7
1. Study of common plants used by tribes. <i>Aegle marmelos</i> , <i>Ficus religiosa</i> , <i>Cynadondactyl</i> . 2. Visit a tribal area and collect information on their traditional method of treatment using crude drugs. 3. Familiarize with at least 5 folk medicines and study the cultivation, extraction, and their medicinal application. 4. Observe the plants of ethnobotanical importance in your area. 5. Visit to an Ayurveda college or Ayurvedic Research Institute / Hospital	
<b>Unit VI: Instrumentation and herbal Preparations</b>	8
Analyze some active ingredients using chromatography /Spectrophotometry Develop capsule of herbs/ Develop herbal oil/ Develop Poultice/ cream	
<b>Unit VII: Pharmacognosy</b>	8
Organoleptic studies of plants mentioned in the theory: 1. Morphological studies of vegetative and floral parts. 2. Microscopic preparations of root, stem, and leaf. 3. Stomatal number and stomatal index. 4. Vein islet number. 5. Palisade ratio. 6. Fibers and vessels (maceration). 7. Starch test 8. Proteins and lipid test	
<b>Unit VIII: Phytochemistry</b>	7
Preliminary phytochemical tests for alkaloids, terpenoids, glycosides, volatile oils, tannins & resins. Any 5 herbal preparations.	

## **Textbooks/ References Books:**

### **Course Books published in Hindi may be prescribed by the Universities.**

1. Plant Ecology And Economic Botany by Dhankar - Sharma - Trivedi, RBD Publication
2. फार्माकोग्नॉसी [Shiva Kant, Pankaj Kumar Brahmiya](#) : Thakur Publication
3. PHARMACOGNOSY ...Hindi Edition (Paperback, Hindi, Dr. Akancha Rashi, KHUSHAL JASWANI), RM Publication
4. प्रयोगात्मक वनस्पति विज्ञान भाग 2 लेखक अशोक बेद्रे तथा अशोक कुमार प्रकाशन रस्तोगी प्रकाशन मेरठ

5. Wallis, T. E. 1946. Text book of Pharmacognosy, J & A Churchill Ltd.
6. Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.
7. Jain S. K. 1989. Methods and approaches in Ethnobotany, Society of Ethnobotanists, Lucknow.
8. Pal, D.C. & Jain, S.K., 1998. Tribal Medicine. Naya Prakash Publishers, Calcutta.
9. Datta & Mukerji, 1952. Pharmacognosy of Indian roots of Rhizome drugs. Bulletin No.1 Ministry of Health, Govt. of India
10. Young Ken, H.W., 1948. Text Book of Pharmacognosy. Blakiston C., Philadelphia.
11. Shukla, R.S., 2000. Forestry for tribal development. A.H. Wheeler & Co. Ltd., India.
12. Raychudhuri, S.P., 1991. (Ed.) Recent advances in Medicinal aromatic and spice crops. Vol.1, Today & Tomorrow's printers and publishers, New Delhi.
13. Singh, D.K and K.V. Peter. 2014. Protected cultivation of horticultural crops. New India Publishing Agency.
14. Khasim S.M Botanical Microtechniques: Principles and Practice.

<b><u>Record Matrix</u></b>	
<b>To be filled by the Institution</b>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt;10%</b>

## **DETAIL SYLLABUS FOR B.Sc.-III Year**



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Course for B.Sc.-V Semester (Botany) Paper-I

**Course Title:** PLANT PHYSIOLOGY, METABOLISM & BIOCHEMISTRY (UG Honors)

**Course Code:** B040501T

**Credit Units:** 4

**Level:** UG

**Course Objectives:** Understand the role of physiological and metabolic processes for plant growth and development.

**Prerequisites:** Basic knowledge of Biology.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Plant water relation, mineral nutrition, transpiration, and translocation</b> Brief idea of diffusion, osmosis, and water potential. Transpiration and its significance, guttation. Criteria of essential elements, symptoms of mineral deficiency. Mechanisms and theories of ion uptake and translocation.	7
<b>Unit II: Carbon oxidation</b> Glycolysis, fate of pyruvate, Krebs cycle, Mitochondrial electron transport system, Oxidative phosphorylation, and factors affecting respiration. Anaerobic respiration and fermentation.	8
<b>Unit III: Nitrogen metabolism</b> Nitrate assimilation, biological nitrogen fixation (examples of legumes and non legumes), physiology and biochemistry of nitrogen fixation, importance of nitrogen metabolism.	7
<b>Unit-IV: Photosynthesis &amp; Lipid metabolism</b> <b>Photosynthesis:</b> Pigments, Electron Transport System and Photophosphorylation, C3 and C4 cycle, CAM pathway, and its significance. <b>Lipid Metabolism:</b> Synthesis and breakdown of triglycerides, oxidation, gluconeogenesis, and its role in the mobilization of lipids during seed germination.	7
<b>Unit-V: Plant Development, Movements, Dormancy &amp; Responses</b> Developmental roles of phytohormones (auxins, gibberellins, cytokinins, ABA, and	8

ethylene). Photoperiodism (SDP, LDP, and day-neutral plants). Phytochrome (discovery, structure, and function). Seed dormancy and vernalization.	
<b>Unit-VI: Biomolecules- Carbohydrate &amp; Lipids</b>	<b>8</b>
<b>Carbohydrates:</b> Nomenclature and classification, Role of monosaccharides (glucose, fructose), disaccharides (sucrose); oligosaccharides; and polysaccharides (structural-cellulose, storage-starch). <b>Lipids:</b> Storage lipids: Fatty acid structure and functions, Structural lipids: Phosphoglycerides.	
<b>Unit-VII: Biomolecules-Proteins &amp; Nucleic acids</b>	<b>7</b>
<b>Proteins:</b> Structure of amino acids, peptide bonds, protein structure (primary, secondary, tertiary, and quaternary), isoelectric point, protein denaturation. <b>Nucleic acids:</b> Structure of nitrogenous bases, structure and function of nucleic acids, nucleic acid denaturation and renaturation.	
<b>Unit-VIII: Enzymes</b>	<b>8</b>
Structure of enzymes: Holoenzyme, apoenzyme, cofactors, coenzymes, and prosthetic group. Mechanism of action (activation energy, lock and key hypothesis, induced-fit theory), factors affecting enzyme activity, allosteric enzymes and abzymes.	

**Course Outcomes:** Students with basic knowledge of biochemical and physiological processes operating in plant system.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/Examination Scheme:**

The evaluation scheme and mode will be as per the guidelines notified by Siddharth University, Kapilvastu, Siddharth Nagar.

<b>Record Matrix</b>	
To be filled by the Institution	
<b>Date of Introduction, of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt;10%</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Course for B.Sc.-V Semester (Botany)**  
**Paper-II**

**Course Title:** MOLECULAR BIOLOGY & BIOINFORMATICS (UG Honors)

**Course Code:** B040502P

**Credit Units:** 4

**Level:** UG

**Course Objectives:** To know about basic concepts of

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

DNA replication, transcription, translation, gene regulation, genetic engineering and bioinformatics including biological databases and phylogenetic analysis.

**Prerequisites:** Basic knowledge of Biology.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Genetic material</b>  Different types of genetic material; DNA structure, packaging, replication (prokaryotes): semi-conservative, conservative, and dispersive modes of replication. Basic mechanism of DNA replication.	7
<b>Unit II: Transcription &amp; Regulation of Gene Expression</b>  Types and structures of RNA (mRNA, tRNA, rRNA), various types of RNA polymerases, transcription mechanism. Genetic code and translation (prokaryotes) Regulation of gene expression in prokaryotes (Lac operon model).	7
<b>Unit III: Principles &amp; techniques of genetic engineering</b>  Basic concept of genetic engineering. Vectors and enzymes used in genetic engineering. PCR and RT-PCR, DNA Finger printing. Blotting techniques: Southern, Northern and Western Blotting,	8
<b>Unit-IV: Applications of genetic engineering</b>  Pest-resistant (Bt-cotton), herbicide-resistant plants (Roundup Ready soybean), Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice). Role of transgenics in bioremediation (superbug), production of industrial enzymes (Protease, Lipase). Hybridoma and monoclonal antibodies.	7

<b>Unit-V: Bioinformatics &amp; its applications (Basic)</b>	<b>8</b>
Brief ideas of programming languages in bioinformatics. Scope of bioinformatics- genomics, transcriptomics, proteomics. Applications and limitations of bioinformatics.	
<b>Unit-VI: Biological databases (Basic)</b>	<b>8</b>
Introduction to biological databases—primary, secondary, and composite databases, NCBI, nucleic acid databases (GenBank, EMBL, DDBJ, NDB), protein databases (PIR, Swiss-Prot, PDB).	
<b>Unit-VII: Data Generation and Data Retrieval Proteins &amp; Nucleic Acids (Basic)</b>	<b>7</b>
Generation of data (gene sequencing, protein sequencing), sequence submission tools (BankIt, Sequin, Webin), sequence annotation, and data retrieval systems (SRS, Entrez).	
<b>Unit-VIII: Phylogenetic analysis (Basic)</b>	<b>8</b>
Similarity, identity, and homology; Alignment-local and global alignment, pairwise and multiple sequence alignments. Methods of Alignment (BLAST and FASTA). Phylogenetic analysis: Construction of phylogenetic trees and methods of construction of phylogenetic trees.	

**Course Outcomes:** Students with basic knowledge of different aspects of molecular biology and bioinformatic tools.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar

**Textbooks/Reference books:**

1. Primrose, SB. 1995. Principles of Genome Analysis. Blackwell Science Ltd., Oxford, UK.
2. E.J. Gardner and D.P. Snustad. Principal of genetics (1984), John Wiley & Sons, New York.
3. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.
4. Freifelder - Molecular Biology.
5. P.K. Gupta. Biotechnology and genomics. Rastogi Publications, 7th Reprint (1st Edition): 2016-2017.
6. Ghosh, Z., Mallick, B. (2008). Bioinformatics – Principles and Applications, 1st edition. New Delhi, Delhi: Oxford University Press.

7. Baxevanis, A.D. and Ouellette, B.F., John (2005). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd edition. New Jersey, U.S.: Wiley & Sons, Inc.
8. Roy, D. (2009). Bioinformatics, 1st edition. New Delhi, Delhi: Narosa Publishing House.
9. Andreas, D., Baxevanis, B.F., Francis, Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins, 3rd edition. New Jersey, U.S.: John Wiley and Sons.
10. Pevsner J. (2009). Bioinformatics and Functional Genomics, 2nd edition. New Jersey, U.S.: Wiley Blackwell.
11. Xiong J. (2006). Essential Bioinformatics, 1st edition. Cambridge, U.K.: Cambridge University Press.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction, of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Course for B.Sc.-V Semester (Botany)**  
**Paper-III Practical**

**Course Title:** EXPERIMENTS IN PHYSIOLOGY, BIOCHEMISTRY, GENETICS & MOLECULAR BIOLOGY (UG Honors)

**Course Code:** B040503P

**Credit Units:** 2

**Level:** UG

**Course Objectives:** To gain experimental knowledge on various physiological, biochemical and metabolic processes operating in plants.

**Prerequisites:** Botany as a major subject in a previous year.

**Course Contents/Syllabus:**

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	02

Descriptors/Topics (Perform any three experiments from each unit based on facility)	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Plant water relations, mineral nutrition, and translocation in phloem</b> 1. Determination of osmotic potential of plant cell sap by the plasmolytic method using leaves of <i>Rhoeo</i> / <i>Tradescantia</i> . 2. Experiment to demonstrate the transpiration phenomenon with the bell jar method. 3. Structure of stomata (dicot and monocot). 4. Determination of the rate of transpiration using cobalt chloride method. 5. Experiment to measure the rate of transpiration by using Farmer's potometer and Ganong's potometer. 6. Assessment of effect of temperature on membrane permeability by colorimetric method. 7. Study of mineral deficiency symptoms using plant material/photographs.	<b>8</b>
<b>Unit II: Nitrogen metabolism, photosynthesis &amp; respiration</b> 1. Separation of plant pigments by solvent and paper chromatography. 2. Estimation of total chlorophyll content from different chronologically aged leaves (young, mature, and senescent) by Arnon method. 3. Effect of $\text{HCO}_3$ concentration on oxygen evolution during photosynthesis in an aquatic plant and to find out the optimum and toxic concentration (either by volume measurement or bubble counting).	<b>8</b>

4. Measurement of oxygen uptake by respiring tissue (per hr.). 5. Determination of the RQ of germinating seeds. 6. Effect of light intensity on oxygen evolution in photosynthesis using Wilmott's bubbler.	
<b>Unit III: Plant development, movements, dormancy &amp; responses</b>	<b>7</b>
1. Geotropism and phototropism- Klinostat method. 2. Hydrotropism. 3. To study the phenomenon of seed germination (effect of light). 4. To study the induction of amylase activity in germinating grains. 5. Test of seed viability by the TTC method.	
<b>Unit IV: Techniques for biochemical analysis</b>	<b>7</b>
1. Weighing and preparation of solutions—percentage, molar and normal solutions, dilution from stock solution, etc. 2. Separation of amino acids by paper chromatography. 3. Detection of organic acids: citric, tartaric, oxalic, and malic from laboratory samples. 4. Qualitative analysis of carbohydrates. 5. Estimation of reducing sugar by the anthrone method. 6. Qualitative analysis of Lipids. 7. Qualitative analysis of amino acids and proteins. 8. Quantitative analysis of nucleic acids. 9. Analysis of dietary supplements, nutraceuticals and antioxidants 10. Testing of adulterants in food items.	
<b>Unit V: Genetic material</b>	<b>7</b>
1. Instruments and equipment used in molecular biology. 2. Preparation of LB medium and cultivating E. coli on it. 3. Isolation of genomic DNA from plants. 5. Examination of the purity of DNA by agarose gel electrophoresis. 6. Quantification of DNA by UV-spectrophotometer.	
<b>Unit VI: Preparation of models/ charts</b>	<b>7</b>
1. Study of experiments establishing nucleic acid as genetic material (Avery et al., Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments) through photographs. 1. Study of DNA replication through photographs: Modes of replication - Rolling circle, Theta and semi-discontinuous; Semiconservative model of replication (Meselson and Stahl's experiment); Telomerase assisted end-replication of linear DNA. 2. Study of structures of: tRNA (2D and 3D); prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs. 3. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozymes and Alternative splicing. 4. Understanding the regulation of lactose (lac) operon (positive & negative regulation) and tryptophan (trp) operon (Repression and De-repression, and Attenuation) through photographs. 5. Understanding the mechanism of RNAi by photographs.	

<b>Unit VII: Genetic Engineering</b>	<b>8</b>
1. Construction of restriction map of circular and linear DNA from the data provided. 2. Isolation of plasmid DNA. 3. Restriction digestion and gel electrophoresis of plasmid DNA (demonstration/photograph). 4. Calculate the percentage similarity between different cultivars of a species using RAPD profile. Construct a dendrogram and interpret results. 5. Agarose gel analysis of plasmid DNA. 6. Restriction digestion of plasmid DNA -Demonstration of PCR	
<b>Unit VIII: Applications of genetic engineering</b>	<b>8</b>
1. Viability tests of cells. 2. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment. 3. Study of steps of genetic engineering for production of Bt cotton, Golden rice and Flavr Savr tomato through photographs.	

### **Textbooks/Reference Books:**

1. Hopkins, W.G. & Hiiner, N.P. Introduction to Plant Physiology (3rd ed.) 2004, John Wiley & Sons.
2. A Handbook On Mineral Nutrition And Diagnostic Techniques For Nutritional Disorders of Crops (pb)ISBN: 9788177543377 Edition: 01 Year: 2011 Author : Pathmanabhan G , Vanangamudi M , Chandrasekaran CN, Sathyamoorthi K , Babu CR , Babu RC , Boopathi PN Publisher : Agrobios (India)
3. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company.
4. Salisbury, F.B. & Ross, C.W. Plant Physiology (4th ed.), 19992, Wadsoworth Publishing Company.
5. Panday, S.N. & Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd.
6. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.
7. Chaudhuri, D., Kar, D.K., and Halder, S.A. Handbook of Plant Biosynthetic Pthways 2008, New CentralBook. Agencies.
8. Voet, D. and Voet, J.G., Biochemistry (3rd ed.), 2005, John Wiley & Sons.
9. Mathews, C.K., Van Holder, K.E. & Ahren, K.G. Biochemistry (3rd ed.), 2000, Pearson Education.
10. Lehninger Principles of Biochemistry. Sixth Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan.
11. Srivastava, HN. 2006. Pradeep's Botany Vol. V. Pradeep Publications, Jalandhar.
12. Verma, SK. Plant Physiology and Biochemistry. S. Chand & Sons, New Delhi.
13. Buchanon, Gruissen, and Jones. Plant Physiology & Biochemistry: Biochemistry and

Molecular Biology of Plants, 2000, I.K. International.

14. Ramesh Gupta. Efficacy, Safety, and Toxicity brings together all current knowledge regarding nutraceuticals and their potential toxic effects. 2016. Elsevier.
15. Harborne, J.B. 1973. Phytochemical Methods. John Wiley & Sons, New York.
16. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.
17. P.K. Gupta. BIOTECHNOLOGY AND GENOMICS. Rastogi Publications, 7th Reprint (1<sup>st</sup> Edition): 2016-2017.
18. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons, Inc.
19. Methods in Plant Biochemistry and Molecular Biology. 1997. Dashek, WV (ed.). CRC Press.
20. Wilson and Walker. Practical Biochemistry: Principles and Techniques. Cambridge University Press, U.K.
21. Thimmaiah, SR. 2004. Standard Methods of Biochemical Analysis. Kalyani Publishers.
22. Henry, RJ. 1997. Practical Application of Plant Molecular Biology. Chapman & Hall, London.

<b>Record Matrix</b>	
<b>To be filled by the Institution</b>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt; 15 %</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Course for B.Sc.-VI Semester (Botany) Paper-I

**Course Title:** CYTOGENETICS, PLANT BREEDING & NANOTECHNOLOGY (UG Honors)

**Course Code:** B040601T

**Credit Units:** 4

**Level:** UG

**Course Objectives:** Acquire knowledge on cell

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

ultrastructure, basic concept of genetics, plant breeding, biostatistics, nanotechnology and AI tools with respect of plant science.

**Prerequisites:** Basic knowledge of Biology.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Cell biology</b>  Structure and function of cell, cell wall, plasma membrane, ribosomes, endoplasmic reticulum, mitochondria, chloroplast, peroxisomes and nucleus. Structure of chromosome, chromosomal nomenclature, chromatids, centromere, telomere, satellite, and secondary constriction. Cell cycle, mitosis and meiosis.	<b>8</b>
<b>Unit II: Genetics</b>  Mendelian theory of inheritance, chromosome theory of inheritance, linkage and crossing over. Gene interaction, extranuclear inheritance, the concept of sex determination and sex chromosomes, and patterns of sex determination in plants.	<b>7</b>
<b>Unit III: Plant breeding</b>  Plant introduction, agencies of plant introduction in India. Procedure of introduction and acclimatization. Selection (mass selection, pure line selection, and clonal selection), hybridization (intergeneric, interspecific, and intervarietal), male sterility. Mutation, molecular breeding and its achievements in India.	<b>8</b>
<b>Unit-IV: Biostatistics</b>  Definition, statistical methods, basic principles, variables—measurements, functions, limitations, and uses of statistics. Central tendency-arithmetic mean, mode, and median, standard deviation. Test of significance: chi-square test for goodness of fit.	<b>7</b>

<b>Unit-V: Plant tissue culture</b>	<b>8</b>
Principles, components, and techniques of in vitro plant cultures, callus cultures, protoplast culture, somatic hybridization—selection of hybrid cells, and somaclonal variation.	
<b>Unit-VI: Nanotechnology</b>	<b>7</b>
Fundamentals of the nanoscale self-assembly process involved in important functional biomolecules such as nucleic acid (DNA and RNA), proteins, and enzymes. Advantages and applications of biologically synthesized nanomaterials. Biominerization, magnetosomes, nano-pesticides, nano-fertilizers and nano-sensors.	
<b>Unit-VII: Artificial intelligence in plant sciences</b>	<b>8</b>
Big Data Analytics, Blockchain Technology, Machine Learning, Expert Systems and Fuzzy Logic, Artificial Neural Networks and Genetic Algorithms, and Applications of Artificial Neural Networks in Plant Science.	
<b>Unit-VIII: Introduction to the use of digital technologies—AI, IoT &amp; ICT in Botany</b>	<b>7</b>
Educational software—INFLIBNET, internet as a knowledge repository—Google Scholar, ScienceDirect. Database management, platforms, Graphical user interface, ICT applications in different crops and horticulture.	

**Course Outcomes:** Students having basic knowledge of plant genetics, plant breeding, nanotechnology, along with implications of AI and statistical tools.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/Examination Scheme:**

The evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A., 10th edition.
2. M. K. Raxdan An Introduction to Plant Tissue Culture—Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. De Robertis, E.D.P., and Robertis, E.M.P. (1991). Cell and molecular biology Scientific American books.
4. Dobzhansky, B. (1961). Genetics and origin of species, Columbia University Press, New York
5. Durbin (2007) Biological Sequence Analysis. Cambridge University Press India Pvt. Ltd.
6. Gerald Karp (1985), Cell biology, McGraw Hill Company.
7. Nicholl T (2007) An Introduction to Genetic Engineering, Cambridge University Press India Pvt.

Ltd.

8. Roy S.C. and Kalayan Kumar De (1997). Cell biology. New Central Books Calcutta
9. Sharma JR (1994) Principles and Practices of Plant Breeding. Tata McGraw-Hill Pub. Co. New Delhi
10. Sharma, A.K and Sharma A (1980) Chromosome technique Theory and practice, Aditya Books, New York.
11. Swanson, C.P (1957) Cytology and Genetics. Englewood cliffs, New York.
12. Taylor (2008) Biological Sciences. Cambridge University Press India Pvt. Ltd
13. H. S. Chawla Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
14. H. D. Kumar Modern concept of biotechnology, Vikas Publishing House, Pvt. Ltd., New Delhi.
15. Plant R. E., Stone N. D. (1991). Knowledge-based systems in agriculture. McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020.
16. Nageshwar Rao G. (2007) Statistics for Agriculture Sciences BS Publications. New Delhi
17. Snedecor GW & Cochran WG. (1989) Statistical Methods. Iowa State University Press.
18. Design and Analysis of Experiments by Das M.N. and Giri N.C. (1986). Wiley Eastern Ltd., New Delhi.
19. Gomez, A.A. and Gomez, A. A. (1984) Statistical Procedures for Agricultural Research. John Wiley and Sons. New York.
20. Gupta, S.C. (2016) Fundamentals of Statistics. Himalaya Publishing House Mumbai - 400004, Maharashtra, India.
21. V.K. Kapoor (2007). Fundamentals of Applied Statistics by Sultan Chand and Sons, New Delhi- 110002
22. Yubing Xie. 2012. Nanotechnology. CRC Press. The Nanobiotechnology Handbook. CRC Press.
23. Sulabha K. Kulkarni. 2014 Nanotechnology: Principles and Practices. CP publishing, New Delhi.
24. B S Murty, P Shankar, Baldev Raj, B B Rath, James Murday. 2012. Textbook of Nanoscience and Nanotechnology. Springer
25. K. K. Chattopadhyay and A. N. Banarjee. 2009. Introduction to Nanoscience and Nanotechnology. PHI Publication.
26. David S. Goodsell. 2004. Bionanotechnology—Lessons from nature. John Wiley Publications.
27. R. Stephen Crespi, Tibtech, Patenting in Biotechnology—Part I, Vol. 9, 117-122, 1991.
28. Pattnaik, P.K., Kumar, R., Pal, S., Panda, S.N. (Eds.) IoT and Analytics for Agriculture, 2020
29. Petersen, Roger G. (1994) Agricultural Field Experiments Design and Analysis by Marcel Dekker, New York.

<b>Record Matrix</b>	
<b>To be filled by the Institution</b>	
<b>Date of Introduction of course:</b>	July, 2025
<b>Date of Last Revision:</b>	Not applicable
<b>Version:</b>	1 <sup>st</sup>
<b>Percentage of revision:</b>	Not applicable (New Course)



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Course for B.Sc.-VI Semester (Botany) Paper-II

**Course Title:** ECOLOGY & ENVIRONMENT (UG Honors)

**Course Code:** B040602T

**Credit Units:** 4

**Level:** UG

**Course Objectives:** To understand the interaction of

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

living organism with their biotic, abiotic component and environment.

along with ecosystem functioning.

**Prerequisites:** Basic knowledge of Biology.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Natural resources &amp; sustainable utilization</b>  Soil degradation and management strategies; Wetlands-threats and management strategies, Ramsar sites. Forests: Forest types in India, minor and major forest products; deforestation, reforestation and afforestation. Energy: Renewable and non-renewable sources.	7
<b>Unit II: Ecology &amp; Ecosystem</b>  Introduction of ecology, ecological factors (abiotic and biotic), Ecosystem structure and function. Food chains, food web and ecological pyramids. Biogeochemical cycles. Ecological adaptations -Hydrophytes, xerophytes, halophytes. Ecological succession-Hydrosere and xerosere.	8
<b>Unit III: Soil formation, properties &amp; conservation</b>  Soil formation and composition, soil profile, soil types in India, Soil erosion. Soil conservation: Biological (mulching, strip cropping, and crop rotation); Mechanical-basin Listing, soil reclamation.	7
<b>Unit-IV: Biodiversity and its conservation</b>  Introduction of biodiversity, types of biodiversity (genetic, species, and ecosystem diversity), hotspots of biodiversity, Red Data Book. Threats and Conservation of biodiversity ( <i>Ex-situ</i> and <i>in-situ</i> conservation,	7

botanical gardens, National Park, Sanctuaries, Bioreserves.) Endemic and endangered plants in India.	
<b>Unit-V: Phytogeography</b>	<b>7</b>
Biogeographic regions of India, natural vegetation of India, basic principles governing geographical distribution of plants (age area hypothesis and continental drift theory), Vegetational types in Uttar Pradesh.	
<b>Unit-VI: Environmental audit &amp; sustainability (Basic)</b>	<b>8</b>
Introductory concepts of environmental audit; Guidelines of environmental audit; concept of energy and green audit, concept of sustainable agriculture; India's environment action programme: issues, approaches and initiatives towards Sustainability.	
<b>Unit-VII: Pollution, waste management &amp; circular economy (Basic)</b>	<b>8</b>
Environmental pollution, environmental protection laws, activated sludge process (ASP), regulatory framework for pollution monitoring and control, implementation of CNG, waste types, collection and disposal, Recycling of solid wastes (hazardous & non-hazardous).	
<b>Unit-VIII: Environmental ethics, carbon credits &amp; role of GIS (Basic)</b>	<b>8</b>
Carbon credit: concept, exchange of carbon credits. Carbon sequestration: importance, meaning, and ways. Climate change, global warming, acid rain, ozone depletion. Geographical Information Systems.	

**Course Outcomes:** Students having knowledge of major environmental factors, concerns and national and international efforts for their management.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. Environmental Studies (Hindi) ISBN 81-301-0004-5B. L. Chaudhary & Jitendra Pandey Edition: 2013 Pages: 340 XII Apex Publishing House
2. Soil and Water Conservation ISBN #: 978-81-301-0071-5S. C. Mahnot & P. K. Singh Apex Publishing House
3. Ecology And Environmental Biology (पारिस्थितिकी एवं पर्यावरण जैविकी) by RBD Publisher Author: Bhatia - Jain - Koh - Shrivastava - Singh - Verma
4. पर्यावरणीय वनस्पति एवं पादप व्याधिकी लेखक :डॉ पी डी शर्मा प्रकाशन: रस्तोगी प्रकाशन मेरठ
5. Paryavaran Evam Paristhithiki 5e (Hindi) Paperback – 20 February 2020 Majid Husain
6. Environmental Biology and Phytogeography ISBN #: 978-81-301-0064-7B. L. Chaudhary, Gotam K Kukda & Jitendra Kumar Joshi
7. Ugc Unified: Environmental Sciences (hindi) (pb) ISBN : 9788177545814 Edition : 01 Year : 2015 Author : Dr. Purohit SS , Dr. Deo PP , Dr. Agrawal Ashok K Publisher : Agrobios (India)
1. Chapman and Riss. Ecology: Principles and Applications, Latest Ed., Cambridge University Press

2. Kumar, H.D. Modern Concept of Ecology, Latest Ed. Vikas Publishing House
3. Begon, M., Herper, J.L., and Townsend, C.R. Ecology—Individuals, Populations, and Communities (3rd ed.), Oxford Blackwell Science.
4. Mani, M.S. Bio-Geography of India, Latest Ed., Springer-Verlag.
5. Mackenzie et al. Ecology, Latest Ed., Viva Books.
6. Gurevitch, J. (et al.), The Ecology of Plants, 2002, Sinauer Associates.
7. Kimar, U. & Asija, M.J. Biodiversity: Principles & Conservation, 2005, Student Edition, Agrobios (India)
8. Cain, Bowman, Hacker. Ecology. 2014. 3rd Ed. Sinauer Associates
9. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
10. Singh, J. S., Singh, S. P., and Gupta, S. (2006). Ecology, Environment, and Resource Conservation. Anamaya Publications, New Delhi.
11. Rogers, P.P., Jalal, K.F., and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.
12. Abbasi, S. A. (1998). Environmental Pollution and its Control. Cogent International, Pondicherry.
13. Peavy, H. S., Rowe, D. R., and Tchobanoglous, G. (1985). Environmental Engineering, McGraw Hill Book Company, Singapore.
14. Rand, M. C., Greenberg, A. E. and Taras, M. J. (Ed.) (1995). Standard methods for the examination of water and wastewater: 19th edition, American Public Health Association (APHA), Washington, D.C.
15. Scragg, A. 1999. Environmental Biotechnology, Addison Wesley Longman, Singapore.
16. George, T., and Frank, K. 2002. Handbook of solid waste management: (Second edition). McGraw Hills.
17. Anonymous. 1997. National Gene Bank: Indian Heritage on Plant Genetic Resources (Booklet). National Bureau of Plant Genetic Resources, New York.
18. Hardy, J.T. 2003. Climate Change: Causes, Effects, and Solutions. John Wiley & Sons.
19. Manahan, S.E. 2010. Environmental Chemistry. CRC Press, Taylor and Francis Group.
20. Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. & Sen, K. 2004. Climate Change and India. Universities Press, India.
21. Richards, J. A. & Jia, X. 1999. Remote Sensing and Digital Image Processing. Springer.
22. Sabins, F. F. 1996. Remote Sensing: Principles and Interpretation. W. H. Freeman.
23. Gaston, K. J. & Spicer, J. I. 1998. Biodiversity: An Introduction. Blackwell Science, London,
24. Sodhi, N.S., Gibson, L. & Raven, P.H. 2013. Conservation Biology: Voices from the Tropics. Wiley-Blackwell, Oxford, UK.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt;15%</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Course for B.Sc.-VI Semester (Botany)**  
**Paper-II Practical**

**Course Title:** LAB ON CYTOGENETICS, BIOSTATISTICS, TISSUE CULTURE ECOLOGY, SOIL SCIENCE & ENVIRONMENT MANAGEMENT (UG Honors)

**Course Code:** B040603P

**Credit Units:** 2

**Level:** UG

**Course Objectives:** To acquire experimental understanding on cytogenetics, tissue culture, breeding and uses of statistical analysis in data interpretation.

**Prerequisites:** Basic knowledge of Biology.

**Course Contents/Syllabus:**

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	02

Descriptors/Topics (Perform any three experiment from each unit as per facility)	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Cell biology</b> 1. Study of plant cell structure with the help of epidermal peel mount of <i>Allium</i> / <i>Rhoeo</i> / <i>Crinum</i> . 2. Measurement of cell size by the technique of micrometry. 3. Counting cells per unit volume with the help of hemocytometer (yeast/pollen grains). 4. Determination of mitotic index and frequency of different mitotic stages in pre fixed root tips of <i>Allium cepa</i> .	7
<b>Unit II: Genetics</b> 1. Monohybrid cross (dominance and incomplete dominance). 2. Dihybrid cross (dominance and incomplete dominance). 3. Gene interactions (all types of gene interactions mentioned in the syllabus) a. Recessive epistasis 9:3:1. b. Dominant epistasis 12:3:1 c. Complementary genes 9:7 d. Duplicate genes with cumulative effect 9:6:1 e. Inhibitory genes 13:3 4. Observe the genetic variations among inter- and intraspecific plants. 5. Demonstration of breeding techniques-Hybridization, case studies of mutation, polyploidy and emasculation experiment.	8

<b>Unit III: Biostatistics</b>	<b>7</b>
1. Univariate analysis of statistical data: Statistical tables, mean, mode, median, 2. Standard deviation and standard error (using seedling population / leaflet size). 3. Calculation of correlation coefficient values and finding out the probability. 4. Determination of goodness of fit in Mendelian and modified Mono- and dihybrid ratios by Chi-square analysis and comment on the nature of inheritance. 5. Computer applications in biostatistics—MS Excel and SPSS.	
<b>Unit IV: Plant tissue culture</b>	<b>8</b>
1. Familiarization of instruments and special equipment used in the plant tissue culture experiments. 2. Micropropagation of potato/tomato—demonstration. 3. Protoplast isolation and culturing—demonstration.	
<b>Unit V: Ecology &amp; environment</b>	<b>8</b>
1. Ecological adaptations- hydrophytes, xerophytes, halophytes, epiphytes, and parasites. a) Study of morphological adaptations of hydrophytes and xerophytes (four each). b) Study of biotic interactions of stem parasite ( <i>Cuscuta</i> ), root parasite ( <i>Orobanche</i> ), epiphytes, and predation (insectivorous plants). 2. Observation and study of different ecosystems mentioned in the syllabus. 3. Field visit to familiarize students with the ecology of different sites.	
<b>Unit VI: Soil formation, properties &amp; conservation genetics</b>	<b>8</b>
1. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper). 2. Analysis of carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests. 3. Soil profile study. 4. Soil types of India- Maps.	
<b>Unit VII: Biodiversity and phytogeography</b>	<b>7</b>
1. Study of community structure by quadrat method and determination of a. Minimal size of the quadrat b. Frequency, density and abundance of components (to be done during excursion/field visit). 2. Marking of vegetation types, phytogeographical region of India and Uttar Pradesh on maps.	
<b>Unit VIII: Pollution &amp; waste management</b>	<b>7</b>
1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge, and lux meter. 2. Estimation of chloride and dissolved oxygen content in water sample. 3. Comparative anatomical studies of leaves from polluted and less polluted areas. 4. Determination of BOD in water samples from polluted and unpolluted sources. 5. Microbiological assessment of drinking water using MPN Technique—water from well, river, water supply department, and	

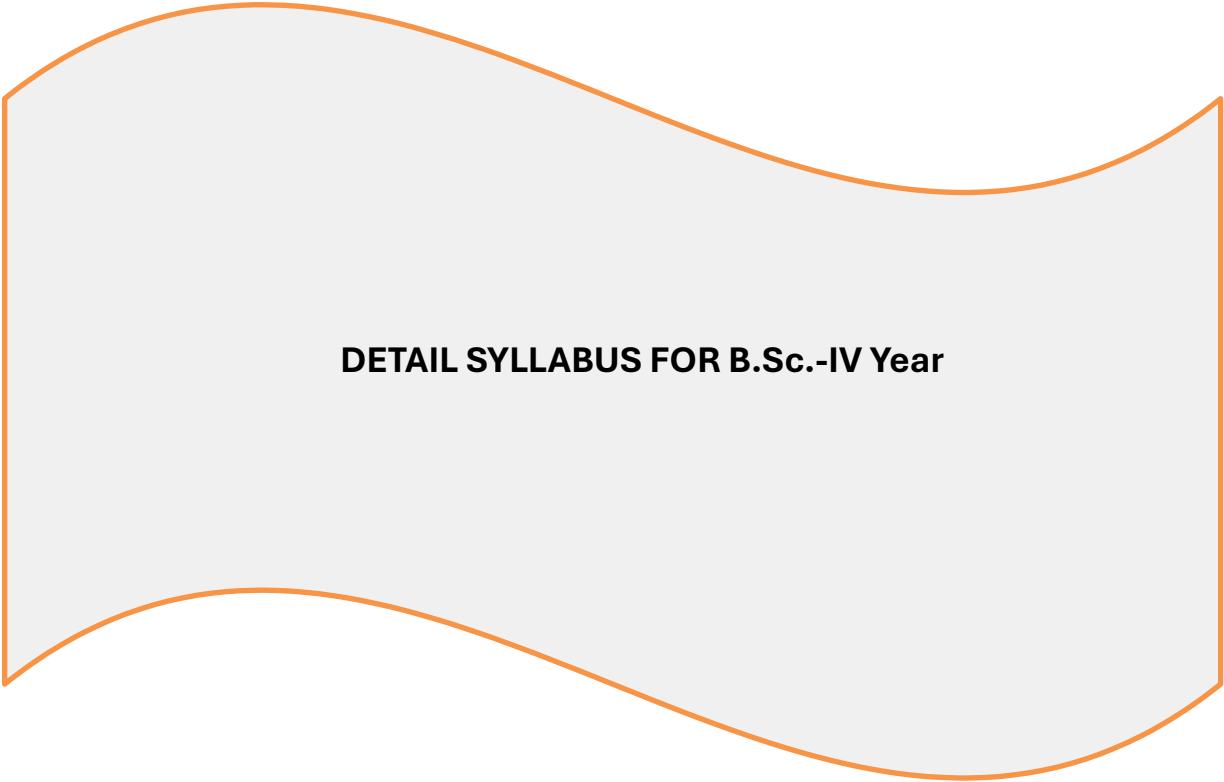
<p>packaged drinking water.</p> <p>6. Preparation of compost/vermicompost.</p> <p><b>Climate Change, Carbon Credits &amp; the Role of GIS</b></p> <ol style="list-style-type: none"> <li>1. Conducting waste audit of your Institution -Demo</li> <li>2. Green auditing of the College/University -Demo</li> </ol>	
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#### **Textbooks/ References Books:**

*Course Books published in Hindi may be prescribed by the Universities.*

1. Practical Botany (Part III) Authors: Sunil D Purohit, Anamika Singhvi & Kiran Tak 2013 Apex Publishing House, Raj.
2. Practical Botany (Part II) Author: N. C. Aery, Sunil D Purohit & Gotam K Kukda 2013 Apex Publishing House, Raj.
3. प्रयोगात्मक वनस्पति विज्ञान भाग 3 लेखक अशोक बेंद्रे तथा अशोक कुमार प्रकाशन रस्तोगी प्रकाशन मेरठ
3. Green Technology: An Approach for Sustainable Environment ISBN: 9788177543438 Edition: 01 Year: 2021 Author: Dr. Purohit SS Publisher : Agrobios (India).
4. Laboratory Manual of Chemical and Bacterial Analysis of Water and Sewage ISBN: 9788177540802 Edition: 01 Year: 2011 Author: Theroux FR, Eldridge EF, Mallmann WL Publisher: Agrobios (India).
5. Methods In Environmental Analysis: Water Soil and Air (2nd Ed.) ISBN: 9788177543087 Edition: 02 Year: 2021 Author: Gupta PK Publisher: Agrobios (India).
6. Water Treatment and Purification Technology ISBN: 9788177540024 Edition: 01 Year: 2009 Author: Ryan Publisher : Agrobios (India).
7. A Handbook of Soil, Fertilizer, And Manure (2nd Ed.) (pb) ISBN: 9788177544152 Edition: 02 Year: 2017 Author: Gupta PK Publisher: Agrobios (India).

<b>Record Matrix</b>	
<b>To be filled by the Institution</b>	
<b>Date of Introduction, of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>2<sup>nd</sup></b>
<b>Percentage of revision:</b>	<b>&lt; 10%</b>



## **DETAIL SYLLABUS FOR B.Sc.-IV Year**



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Course for B.Sc-VII Semester (Botany)**  
**Paper-I**

**Course Title:** ADVANCE MICROBIOLOGY AND PLANT PATHOLOGY (For UG Honors & UG Honors with Research)

**Course Code:** BOUC401

**Credit Units:** 4

**Level:** UG

**Course Objectives:** Strengthening knowledge about advancement in the field of microbiology and plant pathology.

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Credit Distribution of the course		
	Lecture (L)	Tutorial (T)
	04	-
Descriptors/Topics		
Unit-I: Significance of microbes		<b>Total no. of lectures/Teaching Hours (60)</b> <b>15</b>
Microbial symbiosis and their significance. Plant microbiome and plant health (PGPR and defense priming). Microbial fermentations, antibiotics, vaccines. Microbes in bioremediation. Biological control and IPM. Impact of crop diseases on global food security.		
Unit II: Plant pathogen interaction		<b>15</b>
Stages in the development of disease in plants. Bacterial secretion systems, effectors and pathogenesis. Plant immunity. Biochemistry of host-virus interaction (Hypersensitive response), systematic acquired resistance (SAR) Engineering pathogen resistance in plants.		
Unit III: Modern methodologies in plant virology & bacteriology, and important viral and bacterial disease.		<b>15</b>
Purification of plant viruses. Modern methods of plant virus control (cross protection, PDR, RNAi, CRISPR-Cas system). Serological and molecular methods for detection and identification of plant viruses and bacteria.		
<b>Viral and bacterial diseases and control:</b> Symptoms, causal organism, disease		

cycle and control measures of mosaic diseases on tobacco and cucumber, yellow vein mosaic of bhindi, tomato leaf curl, citrus canker, soft rot of fruits and vegetables, scab of potato and little leaf of brinjal.	
<b>Unit-IV: Modern methodologies in fungal pathology and important fungal disease.</b>	<b>15</b>

Molecular identification of fungal species.  
Mycorrhizal fungi and their significance.  
**Fungal diseases and their control:** Symptoms, causal organism, disease cycle and control measures of damping off seedlings, white rust of crucifers, late blight of potato, loose smut of wheat, black stem rust of wheat, early blight of potato, *Alternaria* leaf spot, red rot of sugarcane, wilt of arhar.

**Course Outcomes:** After the completion of the course the students will be able to:

1. Understand the impact and significance of microbes in maintaining a healthy ecosystem.
2. Learn about the host-pathogen interaction and disease management.
3. Gain knowledge about uses of microbes for plant growth promotion and as biocontrol agents.
4. Learn about the methods for detection of plant pathogens.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar

**Textbooks/ References Books:**

1. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition. Singapore, Singapore: John Wiley & Sons.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies. Noida, U.P.: Macmillan Publishers India Ltd.
4. Reven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company.
5. Sharma, P.D. (2011). Plant Pathology. Meerut, U.P.: Rastogi Publication.
6. Rangaswamy, G. 2009, Disease of Crop Plants in India, Prentice Hall of India, New Delhi.
7. Sambamurty. A.V.S.S. 2006, A Text book of Algae, I. K. International Publishing House, Pvt. Ltd., New Delhi.
8. Sharma, P. D. 2012, Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.
9. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
10. Smith. G. M. 1996. Cryptogamic Botany Volume I, Tata Mc Graw Hill, New Delhi.
11. Sundar Rajan. S. 2010. College Botany Volume I, Himalaya Publications, Mumbai.
12. Vashishta, B.R. Sinha, A.K. and Singh, V. P. 1991. Algae, S. Chand and Company, Pvt. Ltd., New Delhi.
13. Pelzar, 1963. Microbiology, Tata Mc Graw Hill, New Delhi
14. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
15. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New

Delhi.

16. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
17. MadhaveeLatha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi
18. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
19. Gokare A. Ravishankar , Ranga Rao Ambati 2019 Handbook of Algal Technologies and Phytochemicals Volume II: Phycoremediation, Biofuels and Global Biomass Production Print ISBN: 9780367178192
20. Amos Richmond Ph.D., Prof. Emeritus, Qiang Hu Ph.D 2013. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, Second Edition Print ISBN:9780470673898.
21. Trigiano Robert N. 2007. Plant Pathology Concepts and Laboratory Exercises. 2 nd Edition, CRC Press. U.K.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu. Siddharth Nagar (UP)- 272202**

**Proposed Course for VII Semester (Botany)**  
**Paper-II**

**Course Title:** TRENDS IN PLANT SCIENCES (For UG Honors & UG Honors with Research)

**Course Code:** BOUC402

**Credit Units:** 04

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** Understanding and strengthening of current research frontiers in ecological science and to develop ability for analysing and interpreting ecological data.

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: IPR &amp; Traditional Knowledge</b>  IPR and WTO (TRIPS, WIPO), Patent Act 1970 and its amendments, TIFAC, NRDC, Rights, Procedure of obtaining patents, Working of patents, Infringement, Copyrights, Trademarks, Geographical Indications, Traditional Knowledge Digital Library, Protection of Traditional Knowledge & Protection of Plant Varieties and Biotech inventions.	15
<b>Unit II: Nanotechnology (Advance)</b>  Fundamentals of nanoscale self-assembly process involved in important functional biomolecules such as Nucleic acid (DNA and RNA), Proteins, Enzymes. Cell structure and organelles, nanoscale assembly of cellular components (cell membrane and liposomes). Nanoscale assembly of microorganisms (virus). Nano-particles synthesis, Biological synthesis of Nanoparticles, Advantages and applications of biologically synthesized nanomaterials. Introduction to biological nanomaterials, Biomineralization, Magnetosomes, nano-pesticides, nano-fertilizers, nano-sensors.	15
<b>Unit III: Stress Physiology</b>  Plant responses to various types of abiotic stresses: drought, salinity, flooding, extreme temperature (low and high), metal toxicity, ozone and UV-B radiations. Oxidative stress and redox metabolism: Reactive oxygen species (ROS)- singlet, superoxide, hydrogen peroxide and hydroxyl radicals in plants. Site of generation and biological effect of ROS- oxidative damage, oxidation of lipids, proteins and nucleic acids. Antioxidant defence mechanisms.	15
<b>Unit IV: Bioinformatics (Advance)</b>  Basics of Bioinformatics & Phylogenetic analysis, Scope of bioinformatics Genomics, Transcriptomics, Proteomics, Metabolomics, Molecular Phylogeny, Applications of bioinformatics;	15

biological databases - NCBI, nucleic acid databases (GenBank, EMBL), protein databases (Swiss-Prot, PDB), metabolic pathway database (KEGG); Advance phylogenetic analysis: Similarity, identity and homology, Alignment – local and global, pairwise and multiple sequence, Methods of Alignment (BLAST and FASTA); Phylogenetic tree and analysis.	
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**Course Outcomes:** After the completion of the course the students will be able to:

1. Gain insight into new methods, techniques and protocols that advance their ability to study and understand the biology of plants.
2. Understand potential of traditional knowledge for human welfare.
3. Learn about the responses of plants to various abiotic stresses.
4. Understand the applications of nanotechnology in various spheres.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. Hopkins and Hunner. 2011. Introduction to plant physiology. Willey Publication. UK. 3. Schulze, 4. Taiz and Zeigar 2010. Plant Physiology
2. Yubing Xie. 2012. Nanotechnology. CRC Press. The Nanobiotechnology Handbook. CRC Press.
3. Sulabha K. Kulkarni. 2014 Nanotechnology: Principles and Practices. CP publishing, New Delhi.
4. B S Murty, P Shankar, Baldev Raj, B B Rath, James Murday. 2012. Textbook of Nanoscience and Nanotechnology. Springer.
5. Ghosh Z, Mallick B (2012) Bioinformatics: Principles and Applications. Oxford University Press. ISBN-13: 978-0-19-569230-3.
6. Rastogi SC, Mendiratta N, Rastogi P (2011) Bioinformatics: Concepts, Skills & Applications. CBS Publishers & Distributors Pvt. Ltd. ISBN: 81-239-1482-2.
7. K. K. Chattopadhyay and A. N. Banerjee. 2009. Introduction to Nanoscience and Nanotechnology. PHI Publication
8. David S. Goodshell. 2004. Bionanotechnology-Lessons from nature. John Wiley Publications.
9. Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation (2010),
10. Ashwani Pareek, S.K. Sopory, Hans J. Bohnert and Govindjee; Springer Publication.
11. Buchanan, Greessam and Jones .2002. Biochemistry and Molecular Biology of plants. American society of plant biology. USA.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Proposed Course for VII Semester (Botany)

#### Paper-III

**Course Title:** TECHNIQUES AND INSTRUMENTATION (For UG Honors & UG Honors with Research)

**Course Code:** BOUC403

**Credit Units:** 04

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** To develop basic knowledge of techniques and instrumentation in students.

**Pre-requisites:** Botany as major subject in previous year.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Culture techniques and microscopy.</b> Sand culture/water culture and controlled soil culture techniques. Tracer techniques: Detection and measurement of isotopes and applications. Microscopy: Bright field, phase contrast, fluorescence, confocal, transmission electron microscopy, scanning electron microscopy.	15
<b>Unit II: Centrifugation and Chromatography Techniques</b> Centrifugation and ultracentrifugation techniques and their applications. Chromatography: Principles and applications of Paper, TLC, Column, Gel Filtration, Affinity, Ion Exchange, HPLC, GC. Flow cytometry.	15
<b>Unit III: Photometric techniques &amp; Instruments.</b> Colorimetry, Spectrophotometry (UV-visible), Fluorescence spectrometry, Chemiluminescence Spectrometry, Atomic Absorption/emission spectrometry. Basic features and principles of IR, Raman, Mass, NMR, ESR	15
<b>Unit IV: Proteomics and genomics related techniques and instruments</b> Electrophoresis techniques and their applications. Amino acid analysis and protein sequencing. Applications and detection of proteins and nucleic acids (Western Transfers and Immune blots and Southern blot), MAB technology. DNA chip technology and Microarray. PCR and RT-PCR.	15

**Course Outcomes:** After the completion of the course the students will be able to:

1. Investigate natural metabolic products of plants using various techniques.
2. Understand growth and development in plant cells through various techniques.
3. Use acquired knowledge in detection of adulterants in food items.
4. Use learned techniques in metabolomic studies.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. Matthew's Plant Virology, R. Hull, 4th edition, 2003, Elsevier.
2. Prescott's Microbiology, J. Willey, L. Sherwood, 10th edition, 2017, McGraw-Hill Education.
3. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology,
4. Edited by A. Hofmann, S. Clokie, 8th edition, 2018, Cambridge University Press.
5. Plant Pathology, G.N. Agrios, 5th edition, 2005, Elsevier.
6. Alcamo's Fundamentals of Microbiology, J.C. Pommerville, 2nd edition, 2013, Jones and Bartlett Learning.
8. Microbiology: An Introduction, G.J. Tortora, B.R. Funke, C.L. Case, 11th edition, 2016,
9. Pearson India Education Webster, J., Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge, U.K.: Cambridge University Press.
10. Textbook of Mycology by A.K. Sarbhoy; ICAR Publications, New Delhi, 2006.
11. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
12. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
13. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
14. MadhavieLatha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi
15. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
16. Gokare A. Ravishankar , Ranga Rao Ambati 2019 Handbook of Algal Technologies and Phytochemicals Volume II: Phycoremediation, Biofuels and Global Biomass Production Print ISBN: 9780367178192
17. Amos Richmond Ph.D., Prof. Emeritus, Qiang Hu Ph.D 2013. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, Second Edition Print ISBN:9780470673898.
18. Trigiano Robert N. 2007. Plant Pathology Concepts and Laboratory Exercises. 2 nd Edition, CRC Press. U.K.

**Record Matrix**

To be filled by the Institution

<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



# SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Proposed Course for VII Semester (Botany)**  
**Paper -IV**

**Course Title:** Landscaping and Floriculture (For UG Honors)

**Course Code:** BOUC404

**Credit Units:** 04

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** To provide basic knowledge about landscaping and floriculture.

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Ornamental plants and cultivation</b> Ornamental plants-flowering annuals, herbaceous perennials, divine vines, shade and ornamental trees, ornamental bulbous and foliage plants, cacti and succulents, palms and cycads, ferns and selaginellas. Cultivation of plants in pots, indoor gardening and bonsai.	15
<b>Unit II: Principles of gardening and important gardens</b> Principles of garden design-English, Italian, French, Persian, Mughal and Japanese gardens, features of garden (garden wall, fencing, steps, hedge, edging, lawn, flower, beds, shrubbery, borders, water garden), some famous gardens of India and world.	15
<b>Unit III: Landscaping</b> Landscaping places of public importance-landscaping highways and educational institutions.	15
<b>Unit IV: Commercialization of floriculture</b> Commercial floriculture- factors affecting flower production, production and packaging of cut flowers(Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Lilium and Orchids). Diseases and pests of ornamental plants.	15

**Course Outcomes:** After the completion of the course the students will be able to:

1. Understand basic concept of floriculture.
2. Initiate commercial floriculture- a start-up.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. John M. Dole and Ronald E. Cawthon. (2005) Floriculture: Principles and Species. Publisher- Pearson/Prentice Hall.
2. Randhawa G.S and Mukhopadhyay A. (1986). Floriculture in India. Allied Publisher Private Ltd.
3. Desh Raj. (2017).Floriculture At A Glance. Kalyani Publishers.
4. Singh AK. (2020). Textbook of Floriculture And Landscaping. New India Publishing Agency- Nipa.
5. Chattopadhyay SK.(2008). Commercial Floriculture Hardcover. Publisher-Gene-Tech Books.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



# SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Proposed Course for VII Semester (Botany)**  
**Paper –V**

**Course Title:** Practical (For UG Honors and UG Honors with Research)

**Course Code:** BOUP405

**Credit Units:** 04

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
	-	04

**Course Objectives:** To acquaint students with basic techniques and methodologies used in microbial and plant sciences.

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Descriptors/Topics (Perform any three experiments from each unit as per facility)	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Experimental Plant Pathology</b>  Study of fermentative diversity of bacteria. Isolation and characterization of soil bacteria. Morphology and staining of nitrogen fixing bacteria. Enumeration of rhizosphere to non-rhizosphere population of bacteria. Isolation of antagonistic bacterial sp. from the rhizosphere. Isolation of phosphate solubilizing microorganisms. Microscopic observations of root colonization by VAM fungi. Isolation of phyllosphere microflora.	<b>15</b>
<b>Unit II: Applied microbiology</b>  Study of diseased plant specimens and materials. Preparation of media for isolation of the pathogen: bacteria (NA) and fungi (PDA). Isolation of pathogens from infected material. Study of the hypersensitive response during virus infection. Insect transmission of plant virus. Purification of plant virus. Serological detection of plant viruses.	<b>15</b>
<b>Unit III: Stress Physiology</b>  Quantitative estimation of proline in water stressed leaf tissues. Quantitative estimation of hydrogen peroxide content in leaf tissues. Qualitative visualization of superoxide anions in stressed leaf tissues. Quantitative estimation of ascorbic acid in plant tissue.	<b>15</b>

<b>Unit IV: Isolation of biomolecules.</b>	<b>15</b>
Chromatographic procedures (gel filtration) for separation of low molecular and high molecular weight leaf extract components. Thin layer chromatography for detection of amino acids Isolation of proteins from leaf sap through precipitation and centrifugation. Separation of proteins by electrophoresis.	

**Course Outcomes:** After the completion of the course the students will have knowledge of basic techniques and protocols used in microbial and plants science related studies.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. Matthew's Plant Virology, R. Hull, 4th edition, 2003, Elsevier.
2. Prescott's Microbiology, J. Willey, L. Sherwood, 10th edition, 2017, McGraw-Hill Education.
3. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology,
4. Edited by A. Hofmann, S. Clokie, 8th edition, 2018, Cambridge University Press.
5. Plant Pathology, G.N. Agrios, 5th edition, 2005, Elsevier.
6. Alcamo's Fundamentals of Microbiology, J.C. Pommerville, 2nd edition, 2013, Jones and Bartlett Learning.
7. Microbiology: An Introduction, G.J. Tortora, B.R. Funke, C.L. Case, 11th edition, 2016,
9. Pearson India Education Webster, J., Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge, U.K.: Cambridge University Press.
10. Text Book of Mycology by A.K. Sarbhoy; ICAR Publications, New Delhi, 2006.
11. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
12. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
13. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
14. MadhavieLatha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi.
15. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
16. Gokare A. Ravishankar , Ranga Rao Ambati 2019 Handbook of Algal Technologies and Phytochemicals Volume II: Phycoremediation, Biofuels and Global Biomass Production Print ISBN: 9780367178192
17. Amos Richmond Ph.D., Prof. Emeritus, Qiang Hu Ph.D 2013. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, Second Edition Print ISBN:9780470673898.
18. Trigiano Robert N. 2007. Plant Pathology Concepts and Laboratory Exercises. 2 nd Edition, CRC Press. U.K.

<b>Record Matrix</b>	
To be filled by the Institution	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>

<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

### Kapilvastu, Siddharth Nagar (UP)- 272202

#### Proposed Course for VII Semester -Botany

**Course Title:** RESEARCH PROJECT-PHASE-1 (For UG Honors with Research only)

**Course Code:** BOUP406

**Credit Units:** 4

**Level:** UG

**Course Objectives:** To development of research potential/skills in students.

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Project
-	-	04

**Pre-requisites:** Botany as major subject in previous year.

**Course Outcomes:** Skilled students with research aptitude.

**Pedagogy for Course Delivery:**

The course will be delivered by allotment of research project and guidance by allotted supervisor/mentor.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

<b>Record Matrix</b>	
To be filled by the Institution	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Proposed Course for VIII Semester -Botany Paper-I

**Course Title: RESEARCH METHODOLOGY (For UG Honors & UG Honors with Research)**

**Course Code: BOUC411**

**Credit Units: 04**

**Level: UG**

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** To acquaint students regarding various aspects of research methodologies.

**Pre-requisites:** Botany as major subject in previous year.

#### **Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Basic concepts of research</b> Meaning of research in biological sciences, Research methods vs Research methodology, Motivation and objectives of research problems. Types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.	15
<b>Unit II: Research design and survey of literature</b> Concept and need, identification of research problem. Basic principles of research design-objectives, introduction, rationale of work, material and methods, designing experiments. Necessity and importance of review of literature in defining a research problem. Primary and secondary sources of literature- reviews, treatise, monographs and web. Literature review in identification of gap areas.	15
<b>Unit III: Data collection, analysis and scientific writing</b> Observation, collection, analysis, interpretation of data. Format of writing research paper, popular scientific articles, review and reports (structure, language, illustrations and tables, reference citation). Principles of biostatistics. Computer applications in data compilation and analysis.	15
<b>Unit IV: Research Ethics</b> Ethical issues, ethical committees, commercialization, copy rights, royalty, IPR, Patent Laws. Trade related aspects of Intellectual Property Rights.	15

Reproduction of published material, plagiarism, acknowledgement, reference citation. Impact factor and citation index.	
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**Course Outcomes:** After the completion of the course the students will be able to:

1. Understand the basic concepts and techniques used in research viz. sampling techniques, research designs and techniques of analysis.
2. Develop understanding of the basic framework of research process.
3. Learn how to review literature and collect data.
4. Develop an understanding of the ethical dimensions of conducting applied research.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Suggested Readings-**

1. Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi.
2. Pawar, B.S. (2009). Theory building for hypothesis specification in organizational studies, Response Books, New Delhi.
3. Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher
4. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
5. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual.
6. Neuman, W.L. (2008). Social research methods: Qualitative and quantitative approaches, Pearson Education
7. Best and Kahn, Research Methodology, PHI Limited.
8. Rand R.Wilcox Fundamentals of modern statistical methods.
9. Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/cole.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

**Proposed Course for VIII Semester -Botany**  
**Paper-II**

**Course Title: ENVIRONMENTAL AWARENESS AND ETHICS (For UG Honors & UG Honors with Research)**

**Course Code:** BOUC412

**Credit Units:** 04

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** To create awareness and understanding among students regarding various environmental issues for achieving sustainable development goal.

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Pollution and waste management</b> Environmental pollution, Environmental protection laws, Regulatory framework for pollution monitoring and control. Bioremediation: Activated Sludge Process (ASP), Trickling filters Oxidation ponds, fluidized bed reactors, membrane bioreactor, and neutralization. ETP and sludge management: digesters, up flow anaerobic sludge blanket reactor, fixed film reactors, sequencing batch reactors, hybrid reactors and bioscrubbers.	<b>15</b>
<b>Unit II: Types of waste &amp; Circular Economy</b> Waste: Types, collection and disposal. Recycling of solid wastes (hazardous & non-hazardous): classification, collection and segregation, incineration, pyrolysis and gasification, sanitary land filling, composting, biogas production. Concept of circular Economy & sustainability.	<b>15</b>
<b>Unit III: Environmental audit &amp; Sustainability</b> Concept of environmental audit; Guidelines of environmental audit; Methodologies adopted along with some industrial case studies; Environmental standards: ISO 14000 series; Scheme of labeling of environment friendly products (Ecomark); Life cycle analysis; Concept of energy and green audit, Sustainability indices; Strategies and debates on sustainable development; Concept of Sustainable Agriculture; India's environment action programme: issues, approaches and initiatives towards Sustainability; Sustainable development in practice; Urbanization; Concept and characteristics of smart city; Urban resources and environmental	<b>15</b>

problems; Carrying capacity analysis; Concept of ecological footprints.	
<b>Unit IV: Environmental ethics, carbon credits and role of GIS</b>	<b>15</b>
Carbon credit: concept, exchange of carbon credits. Carbon sequestration, importance, meaning and ways.	
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Clean development mechanism.	
Geographical Information Systems: definitions and components; spatial and non-spatial data; GIS software packages; GPS survey, data import, processing, and mapping. Applications and case studies of remote sensing and GIS in land use planning, forest resources and agriculture studies.	

**Course Outcomes:** After the completion of the course the students will be able to understand the relationship of humans and environment and their moral obligation to protect the environment.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbooks/ References Books:**

1. Green Technology: An Approach For Sustainable Environment ISBN : 9788177543438 Edition : 01 Year : 2021 Author : Dr. Purohit SSPublisher : Agrobios (India).
2. Gillespie, A. 2006. Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries Policy and Science Considerations. Martinus Nijhoff Publishers.
3. Odum, F.P. Fundamentals of Ecology, Latest Ed., Saunders
4. Mani, M.S. Bio-Geography of India, Latest Ed., Springer-Verlag.
5. Mackenzie et al. Ecology, Latest Ed., Viva Books.
6. Gurevitch, J. (et al.), The Ecology of Plants, 2002, Sinauer Associates.
7. Lo, C.P. & Yeung, A.K.W. Concepts and Techniques of Geographic Information Systems, 2002, Printice-Hall of India.
8. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
9. Rogers, P.P., Jalal, K.F., and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.
10. Peavy, H. S., Rowe, D. R., and Tchobanoglous, G. (1985). Environmental Engineering, McGraw Hill Book Company, Singapore.
11. Scragg, A. 1999. Environmental Biotechnology, Addison Wesley Longman, Singapore.
12. Tchobanoglous, G. 1988. Wastewater Engineering: Treatment, Disposal, Reuse. Tata McGraw Hill, New Delhi.
13. George, T., Hilary, T. and Samuel, A. V. 1993. Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw-Hill.
14. George, T., and Frank, K. 2002. Handbook of solid waste management: (Second edition). McGraw Hills.
15. Gillespie, A. 2006. Climate Change, Ozone Depletion, and Air Pollution: Legal Commentaries with Policy and Science Considerations. Martinus Nijhoff Publishers.

**16.** Philander, S.G. 2012. Encyclopedia of Global Warming and Climate Change (2nd edition). Sage Publications.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Proposed Course for VIII Semester -Botany

**Course Title: PLANT SYSTEMATICS (For UG Honors & UG Honors with Research)**

**Course Code: BOUC413**

**Credit Units: 04**

**Level: UG**

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Course Objectives:** To develop observation and evolutionary analysis skill in the students with respect to angiosperms.

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Significance of systematics and different classification systems of angiosperm</b>	15
Principles of systematics, relevance and role of systematics; approaches to classification, phenetic, phylogenetic and cladistics. Relative merits and demerits of major systems of classification viz. Bentham and Hooker, Engler and Prantl, Hutchinson, Cronquist, Dahlgren and Thorne, APG system, Origin and Evolution of Angiosperms.	
<b>Unit II: Herbarium techniques, botanical gardens and species concepts</b>	15
Herbarium and Botanical Gardens. ICN (history, principles and applications), Protologue and Botanic literature (Monographs, icons, floras and taxonomic literature); Species Concept: various models; Speciation and Variation. Phytogeography with special reference to discontinuous areas, endemism, hotspots and hottest hotspots GIS and Phylocode.	
<b>Unit III: Modern tools in plant systematics</b>	15
Modern tools and evidence of taxonomy viz: morphology, anatomy, embryology, palynology, reproductive biology, cytotaxonomy, phytochemistry and ecology.	
<b>Unit IV: Interrelationship between families</b>	15
Sexual dioecism, Interesting taxonomic features and interrelationships of following dicot families: Ranunculaceae, Nymphaeaceae, Papaveraceae, Capparaceae, Caryophyllaceae, Malvaceae, Bombaceae, Tiliaceae, Fabaceae, Rosaceae, Passifloraceae, Cucurbitaceae, Cactaceae, Rubiaceae, Lamiaceae, Polygonaceae, Asteraceae, Primulaceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Acanthaceae, Amaranthaceae, Euphorbiaceae, Casuarinaceae, Aizoaceae. Special features of Insectivorous/Parasitic and Saprophytic families.	
Interesting taxonomic features and inter-relationships of following Monocot families and treatment of monocots in evolutionary systems of classification: Alismataceae, Arecaceae, Commelinaceae, Cyperaceae, Liliaceae, Orchidaceae, Poaceae, and Zingiberaceae.	

**Course Outcomes:** After the completion of the course the students will:

1. Able to observe, record, and employ plant morphological variation and the accompanying descriptive terminology.
2. Develop observational skills and field experience.
3. Comprehend the concepts of plant taxonomy and classification of angiosperms according to modern approaches.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbook/Reference book:**

1. Davis, P. H. and V. H. Heywood. 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi
2. Eames, A.J. 1961. Morphology of Angiosperms. McGraw Hill, NY.
3. Naik, V. N. 1984. Taxonomy of Angiosperms Tata McGraw-Hill Publication Com
4. Pandey, B.P. 2007. Taxonomy of Angiosperms. S. Chand and Company Limited. New Delhi
5. Harborne, Turner and Boulter- Chemotaxonomy of Leguminosae, Academic Press, London, 1971.
6. John Firminger Duthie- Flora of Upper Gangetic Plants, Shiva offset Press, vol.I, 1903, vol.II, 1911.
7. John Hutchinson- The families of flowering plants, Clorendon Press, 1959.
8. Arthur John Cronquist- The evolution and classification of flowering plants, Shiva offset Press, 1981.
9. Alfred Barton Randle- The classification of flowering plants, Harvard University, 1904.
10. Gurcharan Singh- Plant systematic, Oxford & IBH Publishing Company Pvt. Ltd., 1999.
11. Tod F. Stuessy-Plant taxonomy, Shiva offset Press, 2002.
12. Peter H.A. Sneath and Robert R. Sokal- Numerical taxonomy, Wayne State University Press, 1973.
13. T. Pullaiah- Taxonomy of angiosperms, Regency Publications, New Delhi, 1998.
14. Sharma, O.P. 2009. Plant Taxonomy. Tata McGraw-Hill. Mumbai.
15. Singh Gurcharan. 2004. Plant Systematics: Theory and practice Oxford and YBH, Publishing Co. Pvt. Ltd., New Delhi.
16. Singh G. 2004. Plant Systematics. Science Publishers. New Delhi.
17. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.

<b>Record Matrix</b>	
To be filled by the Institution	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

### Kapilavastu, Siddharth Nagar (UP)- 272202

#### Proposed Course for VIII Semester -Botany

**Course Title:** CONSERVATION BIOLOGY (For UG Honors only)

**Course Code:** BOUC414

**Credit Units:** 04

**Level:** UG

**Course Objectives:** To get an overview of the of plant diversity, and strategies for its exploration and conservation.

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
04	-	-

**Pre-requisites:** Botany as major subject in previous year.

**Course Contents/Syllabus:**

Descriptors/Topics	Total no. of lectures/Teaching Hours (60)
<b>Unit I: Concepts of biodiversity and threats for biodiversity</b>	<b>15</b>
Plant diversity concepts, importance of species diversity in ecosystems, Concept of diversity, biodiversity hotspots. Levels of Biodiversity - Ecosystem diversity, Species diversity and its measure (species richness, evenness, abundance and genetic diversity) Abiotic and biotic factors affect biodiversity, threats for biodiversity.	
<b>Unit II: Biodiversity conservation, Red list, IUCN</b>	<b>15</b>
Need for biodiversity conservation, types of conservation (preventive, remedial and restoration). Current status of biodiversity conservation and Red list index. Conservation status by IUCN red list categorized criteria. Community based conservation strategies. Indigenous and traditional knowledge in biodiversity conservation.	
<b>Unit III: Approaches for biodiversity conservation</b>	<b>15</b>
<i>In-situ</i> conservation - Protected areas and their types, Biosphere reserves, National parks, Wildlife sanctuaries and Sacred groves. <i>Ex-situ</i> conservation- Botanical gardens, Seed banks. <i>In-vitro</i> storage of germplasm and cryopreservation.	
<b>Unit IV: Biodiversity policies and authorities</b>	<b>15</b>
International and National conservation policies, Role of government agencies and NGOs in plant conservation. General account of important authorities and institutions - UNEP, DST, MoEF&CC, BSI, NBPGR, CPCB, NMPB, AYUSH.	

**Course Outcomes:** After the completion of the course the students will:

1. Develop an understanding about importance of protected areas.
2. Understand the role of government and non-government organizations in conservation of biodiversity.

**Pedagogy for Course Delivery:**

The course will be delivered in the form of lectures and discussions.

**Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

**Textbook/ Reference book:**

1. Gurevitch, J. (et al.), The Ecology of Plants, 2002, Sinauer Associates.
2. Kimar, U. & Asija, M.J. Biodiversity: Principles & Conservation, 2005, Student Edition, Agrobios (India)
3. Krishnamurthy, K.V. An Advanced Textbook on Biodiversity, 2003, Oxford & IBH Publishing Co. Ltd.
4. Mitra, D., Guha, J.K., Chowdhury, S.K. Studies in Botany, Vol. II (7th ed.). Moulik Library.
5. Primack, R.B. Essentials of Conservation Biology, 1993, Sinauer Associates.
6. Rogers, P.P., Jalal, K.F., and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.
7. Anonymous. 1997. National Gene Bank: Indian Heritage on Plant Genetic Resources (Booklet). National Bureau of Plant Genetic Resources, New York.
8. Gaston, K. J. & Spicer, J. I. 1998. Biodiversity: An Introduction. Blackwell Science, London,
9. Singh, J. S. & Singh, S. P. 1987. Forest vegetation of the Himalaya. The Botanical Review 53:80-192.
10. Sodhi, N.S. & Ehrlich, P.R. (Eds). 2010. Conservation Biology for All. Oxford University Press.
11. Sodhi, N.S., Gibson, L. & Raven, P.H. 2013. Conservation Biology: Voices from the Tropics. Wiley-Blackwell, Oxford, UK.

<b>Record Matrix</b>	
To be filled by the Institution	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilavastu, Siddharth Nagar (UP)- 272202**

### Proposed Course for VIII Semester -Botany

**Course Title:** FIELD VISIT, REPORT WRITING AND PRESENTATION (For UG Honors only & UG Honors with Research)

**Course Code:** BOUF415

**Credit Units:** 04

**Level:** UG

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Practical (P)
-	-	04

**Course Objectives:** To obtain experience in field exploration, sample collection, data collection, report writing including data presentation in seminars and symposium.

**Pre-requisites:** Botany as major subject in previous year.

#### **Course Contents/Syllabus:**

Activity	Weightage %
1. Field exploration tour to protected areas data collection on allotted/selected parameters and data analysis.	25%
2. Visit to NBRI/ CIMAP/ BSI, Allahabad/other National or State laboratories or Institutions present in adjoining areas.	25%
3. Power point presentation of data.	25%
4. Report writing and its submission.	25%

**Course Outcomes:** After the completion of the course the students will be able to design and conduct field exploration tour. They know the methodologies of data collection, data analysis and how to present data.

**Pedagogy for Course Delivery:** Field visit, expert guidance during field observation, data collection and data analysis.

#### **Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilavastu, Siddharth Nagar.

<b>Record Matrix</b>	
To be filled by the Institution	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>



## SIDDHARTH UNIVERSITY

**Kapilvastu, Siddharth Nagar (UP)- 272202**

### Course for VIII Semester -Botany Paper

**Course Title:** RESEARCH PROJECT-PHASE-II (For UG Honors with Research)

**Course Code:** BOUP416

**Credit Units:** 4

**Level:** UG

**Course Objectives:** Development of research potential/skills in students.

Credit Distribution of the course		
Lecture (L)	Tutorial (T)	Project
-	-	04

**Pre-requisites:** Botany as major subject in previous year.

**Course Outcomes:** Skilled students with research aptitude.

#### **Pedagogy for Course Delivery:**

The course will be delivered by allotment of research project and guidance by allotted supervisor/mentor.

#### **Assessment/ Examination Scheme:**

Evaluation scheme and mode will be as per the guidelines notified by the Siddharth University, Kapilvastu, Siddharth Nagar.

<b>Record Matrix</b>	
<u>To be filled by the Institution</u>	
<b>Date of Introduction of course:</b>	<b>July, 2025</b>
<b>Date of Last Revision:</b>	<b>Not applicable</b>
<b>Version:</b>	<b>1<sup>st</sup></b>
<b>Percentage of revision:</b>	<b>Not applicable (New Course)</b>