

ST. XAVIER'S COLLEGE (AUTONOMOUS)

AHMEDABAD

Botany Syllabus for Four-Year Undergraduate Programme as per National Education Policy (NEP-2020) (Semester I)



(EFFECTIVE FROM JUNE 2023)

ST. XAVIER'S COLLEGE (Autonomous), AHMEDABAD
BOTANY
Theory syllabus

PROGRAMME SPECIFIC OUTCOMES

PSO1: Knowledge: Understanding the nature and basic concepts of all the plant groups, their morphonology, anatomy, taxonomy, physiology, biochemistry, genetics, components at the molecular level, the relationship between structure and function, plant diversity, and ecology.

PSO2: Laboratory skills: Students learn to carry out practical work in the field and in the laboratory related to interpreting plant morphology and anatomy, plant identification and collection, vegetation analysis techniques, physiochemical analyses of plant materials, analysis of data using appropriate statistical methods, documentation of field visits, visits to gardens and nurseries.

PSO3: Environmental concern: Students become aware of natural resources and understand the impact of plant diversity in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development with respect to assessment, conservation and utilization of floral diversity.

PSO4: Employability/future prospects: Students develop critical thinking, scientific attitudes, problem-solving skills, presentation skills, teamwork capacities, and an aptitude that is highly valuable to employers in the sector of academia, research and industry and which will facilitate them for taking up and shaping successful careers in Botany.

PSO5: Scientific communication: Effective written and oral scientific communication skills, especially the ability to transmit the fundamental concepts of the subject in a clear and concise manner.

PSO6: Life-long learning: Students are prepared for lifelong learning by drawing attention to the vast world of knowledge of plants and by enhancing their ability to engage in independent learning by introducing them to the methodology of systematic academic inquiry.

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – I of the following department under Faculty of Science based on Under Graduate Curriculum Framework - 2023 to be implemented from the Academic Year 2023-24.

FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

Course	Title	Content	Hours/week	Credit
DSC-1 (Theory)	Basics of Botany-I	U-1: Plants and Environment U-2: Genetics and Molecular Biology U-3: Plant Diversity: Study of Lower Plants U-4: Morphology, Anatomy of Angiosperms and Micro Technique	4 hrs	4
DSC-1 (Lab)	Basics of Botany Practical-I	Practical based as per Theory syllabus.	8 hrs	4
Minor (Theory)	Fundamentals of Botany-I	U-1: Plant Diversity: Study Of Lower Plants U-2: Morphology, Anatomy Of Angiosperms And Micro Technique	2 hrs	2
Minor (Lab)	Fundamentals of Botany Practicals-I	Practical based as per Theory syllabus.	4 hrs	2
SEC	Botany Lab operations and Safety measures	U-1: Botany Lab operations U-2: Botany Safety measures	2 hrs	2
MDC	Plant Biodiversity	U – I: Biodiversity: Global and Indian U– II: Biomes & Natural History U– III: Plant Diversity U– IV: Human-Wildlife Interaction	4 hrs	4
AEC		(To be offered by the concerned subject Department)		
VAC		(To be offered by the concerned subject Department)		

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FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

BSc. (Hons.) Botany

Major Course – I: Basics of Botany I

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Basics of Botany I (BO-1501)	04	0	0	10 + 2 from a recognized board in any stream	Basic Knowledge of Biology

LEARNING OBJECTIVES (LO)

LO-1	To be acquainted with basic concepts of Ecology and Environment and will be able to understand the interactions taking place in the Ecosystem and the flow of energy; also, they will understand the concept of sustainable biodiversity through a case study.
LO-2	To understand the structure, composition, and role of DNA and RNA and learn about their importance and the processes of replication and protein synthesis.
LO-3	To understand the systematic position, distribution, morphology, structural organization, and reproduction of Algae, Fungi, Bryophytes, and Pteridophytes. They will also increase their awareness and appreciation of human-friendly Algae and Fungi

	and their economic importance
LO-4	To know the morphology, structure and functions of various parts of plants; learn about various kinds of plant tissues, their general characters and functions, as also know the techniques of staining them.
Course OUTCOMES (CO)	
On Completion of this course, the student will be able to	
CO-1	Describe basic concepts of Ecology and ecosystem and will be able to discuss sustainable development in the context of environmental concerns
CO-2	Explain the structure, composition, and function of DNA and RNA and describe the processes of replication and protein synthesis.
CO-3	Describe the systematic position, distribution, morphology, structural organization and reproduction of lower plant groups and evaluate economic importance.
CO-4	Identify the structure and functions of various parts of plants, explain various kinds of plant tissues and apply the technique of staining.

Unit-I: PLANTS AND ENVIRONMENT

(15 L)

1. Introduction, objective, scope, branches, and applications of Ecology.
2. Ecosystems:
 - Kinds of Ecosystems: Natural, Artificial
 - Structure and Functions of Ecosystems
 - Ecological Pyramids, Productivity of an Ecosystem, Energy flow in an Ecosystem
 - Biogeochemical Cycles-Carbon, Nitrogen, Phosphorus, Sulphur
 - Components of Freshwater Ecosystem (Pond) and Terrestrial Ecosystem (Grassland).
 - Food chain and food web.
3. Biotic Factors:
 - Symbiosis: Mutualism, Proto-cooperation, Commensalism
 - Antagonism: Predation, Parasitism, Antibiosis, Competition, Saprophytism
4. Concept of Sustainable Biodiversity:
 - Case study: The Messenger Pigeon gone forever.

Unit-II: GENETICS AND MOLECULAR BIOLOGY

(15 L)

1. DNA and RNA: Composition and Structure
2. Watson and Crick's model of DNA
3. Types of RNA
4. DNA Replication
5. Genetic code
6. Protein Synthesis
7. **Mendel's law of inheritance with examples.**

Unit-III: PLANT DIVERSITY: Study of lower plants

(15 L)

ALGAE

1. **Outline Classification of Algae by G.M. Smith (1955).**
2. **General characters of Algae.**
3. General account of Cyanophyta.
4. General account of Chlorophyta.
5. Type studies: Distribution, life cycle, and systematic position of *Spirogyra*.
6. **Economic importance of Algae.**

FUNGI

1. **Outline Classification of Fungi. By G.C. Ainsworth (1973).**
2. **General characters of Fungi.**
3. Type studies: Distribution, life cycle, and systematic position of *Mucor*.
4. **Economic importance of Fungi.**

BRYOPHYTA

1. General characters of Bryophytes.
2. Type studies: Distribution, life cycle, and systematic position of *Riccia*.

PTERIDOPHYTA

1. General characters of Pteridophytes.
2. Type studies: Distribution, life cycle, and systematic position of *Nephrolepis*

Unit-IV: MORPHOLOGY, ANATOMY OF ANGIOSPERMS AND MICRO TECHNIQUE (15 L)

1. Leaf
 - a. Simple and Compound leaves.
 - b. Types of Leaf incisions. Leaf margin. Leaf tip.
 - c. Phyllotaxy.
2. Bracts- Scaly, Involucral, Foliaceous, Petaloid and Spathe.
3. Flower- Complete, incomplete, actinomorphic, zygomorphic, irregular.
4. Inflorescence- Racemose, Cymose, and special kinds.
5. General characters and functions of various kinds of plant tissues:
 - a. Meristematic tissues.
 - b. Simple tissues.
 - c. Complex tissues.
6. Micro technique: Stains and Staining.

Suggestive Reading:

- Miller, G. Tyler; *Textbook of Ecology*, New Delhi: Cengage Learning India, 2009.
- Odum, E.; Barrick M.; Barrett G.; *Fundamentals of Ecology*, 5th edition; New Delhi: Cengage Learning India, Pvt. Ltd., 1971.
- Sharma, P.D.; *Ecology and Environment*; 7th edition; Meerut: Rastogi Publishers, 1998.
- Subrahmanyam, N.S.; Sambamurty, A.V.S.S.; *Ecology*; 1st edition; New Delhi: Narosa Publishing House, 2000.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D.; *Molecular Biology of the Cell*. New York: Garland Publishing, Inc.

- J. D. Watson, T. A. Baker, S. P. Bell, A. Gann, M. Levine, R. Losick; *Molecular Biology of the Gene*, 5th Edition; Pearson Education, 2004.
- Kleinsmith, L.J. and Kish, V.M.; *Principles of Cell and Molecular Biology*, 2nd Ed., New York, USA: Harper Collins College Publishers, 1995.
- Lewin, B. *Genes VIII*; New York: Oxford University Press, 2000.
- Wolfe, S.L.; *Molecular and Cellular Biology*. California, USA: Wadsworth Publishing Co., 1993.
- Alexopoulos, Constantine J.; Mims, Charles W; *Introductory Mycology*; 3rd edition; New Delhi: Wiley Eastern Limited , 1983.
- Dutta, A.C.; *A Class-book of Botany*; 15th edition; Calcutta: Oxford University Press, 1976.
- Gangulee, H.C., Das, K.S., Dutta C.T.; *College Botany Vol I*; Kolkatta: New Central Book Agency, 2002.
- Kar, Ashok Kumar; Gangulee, Hirendra Chandra; *College botany: Volume II*; 2nd edition; Kolkata: New Central Book Agency (P) Ltd, 1989, 2006.
- Parihar, N.S.; *Pteridophytes: An Introduction to Embryophyta*, Vol. II; 4th edition; Allahabad: Central Book Depot, 1962.
- Singh V., Pande P.C., Jain D.K.; *A Textbook of Botany*, 4th Edition; Rastogi publications, 2013.
- Smith, Gilbert M; *Cryptogamic Botany Algae & Fungi Volume 1*; 2nd edition; McGraw-Hill Book Comp. Tokyo, 1955.
- Smith, Gilbert M; *Cryptogamic Botany Bryophyta & Pteridophyta Volume 2*; 2nd edition; McGraw-Hill book Comp. Tokyo, 1955.
- Sporne, K.K. 1991. *The Morphology of Pteridophytes*. B.I. Publishing Pvt. Ltd. Bombay.
- Vasishtha B.R. and Sinha A. K. - *Botany for Degree Students Part 1 ALGAE*; S. Chand & Company Ltd, 1st edition, revised 2005.
- Vasishtha B.R. and Sinha A. K.- *Botany for Degree Students Part 2 FUNGI*; S. Chand & Company Ltd, 1st edition, revised 2005.
- Webster, J.1985. *Introduction to Fungi*; Cambridge University Press. Publishing Co., 1967.
- Lawrence, George H.M.; *Taxonomy of Vascular Plants*; 1st edition; New Delhi: Oxford & IBH.
- Naik, V.N. 1984. *Taxonomy of Angiosperms*; New Delhi: Tata McGraw - Hill Publishing Co. Ltd., 1984.
- Sharma, O.P.; *Plant Taxonomy*; 1st edition, reprint; New Delhi: Tata McGraw-Hill Publishing Co. Ltd., 1993(2002).
- Sivarajan, V.V.; *Introduction to the Principles of Plant Taxonomy*; 2nd edition; Cambridge: Cambridge University Press, 1991.
- Subramanian, N.S.; *Modern Plant Taxonomy*; New Delhi: 1st edition; Vikas Publishing House Pvt. Ltd., 1995.
- Eames, Arthur J.; Mc Daniels, Laurence H.; *An Introduction to Plant Anatomy*; 2nd edition. Reprint; New Delhi: Tata McGraw-Hill Publishing Company Limited, (1978, 2004).
- Esau, Katherine; *Anatomy of Seed Plants*; 2nd edition; New York: John Wiley & Sons, 1977.
- Fahn, A; *Plant Anatomy*; 4th edition. Indian reprint; New Delhi: Aditya Books (P) Ltd., 1990(1997).
- Tayal M.S.; *Plant Anatomy*; Rastogi publications, 1983.

Suggested Online Links/Readings:

<https://swayam.gov.in>

[https://www.iscnagpur.ac.in/knowledge_learning_files/5.7 General Open Access e-Resources.pdf](https://www.iscnagpur.ac.in/knowledge_learning_files/5.7_General_Open_Access_e-Resources.pdf)

<https://www.tkd1.res.in/tkd1/langdefault/common/Home.asp?GL=Eng>

<https://ndl.iitkgp.ac.in>

<https://nptel.ac.in/course.html>

www.ncert.in

<https://books.google.co.in>

Pedagogy:

1. Lecture method with teaching aids.
2. Audio-Visual Teaching mode with Projector Method.
3. Dialogue and context-based class.
4. Assignments, Learning seminars, Class Tests etc.
5. Open Online Sources and Tutorials.

MODE OF EVALUATION:

Evaluation will be divided into two parts.

ASSESSMENT	MARKS
INTERNAL	
Attendance	05
Assignment (Research component)	10
Continuous Internal Assessment I and II	35
TOTAL	50 marks
EXTERNAL	
End Semester Exam	50 marks

Students will prepare and present (in pairs) a Submission related to the topic of the Research Assignment on allotted topics. These submissions will be presented in the form of PPT/ Activity/Handwritten notes/ Article/Poster/ etc. Points for evaluation: Presentation (20%) + Content (20%) + Explanation (20%) + Creativity (20%) + Overall impression (20%).

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FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

BSc. (Hons.) Botany
Category – IV

Major Course – II: Basics of Botany Practicals- I

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Basics Of Botany Practicals - I (BO-1502 L)	0	0	4	10 + 2 from a recognized board in any stream	Basic Knowledge of Biology, observation, and Analytic skills

LEARNING OBJECTIVES (LO)

LO-1	To acquire knowledge on Ecology and Ecosystems through chart study
LO-2	To learn about the structure, composition, and role of DNA and RNA and their replication and Protein synthesis through the study of Charts.
LO-3	To demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Algae, Fungi, Bryophytes, and Pteridophytes.
LO-4	To get familiarized with the basic skills and techniques related to plant morphology and anatomy.

LO-5	To gain knowledge on Microscopy and types of stains.
Course OUTCOMES (CO)	
On Completion of this course, the student will be able to	
CO-1	Relate an attitude, value system, and ethics towards environmental issues
CO-2	Describe the structure of DNA and RNA, genetic codes, RNA and DNA replication and Protein synthesis through Chart study.
CO-3	Identify selected lower plants and their vegetative, reproductive structures.
CO-4	Identify plant morphology using observation skills and evaluate internal characters using anatomical skills.
CO-5	Explain the functioning of Microscopy and will be able to prepare stains.

UNIT 1: PLANTS AND ENVIRONMENT

1. Study of Biotic Factors-I examples of Symbiosis (through charts/models/specimens)

- a. Symbiosis:
 - i. Mutualism: Root nodules and Lichens
 - ii. Protocooperation- Hermit crab and Fierasfer fish.
 - iii. Commensalism: Epiphytes-Orchid.

2. Study of Biotic Factors-II examples of Antagonism (through charts/models/specimens)

- b. Antagonism:
 - i. Predation: *Utricularia*, *Nepenthes*, and *Drosera*.
 - ii. Parasitism- *Cuscuta*, and *Loranthus*.
 - iii. Antibiosis: **Penicillin**

3. Study of Abiotic factors I- Determination of pH from the given water samples.

4. Study of Abiotic factors II- Determination of basic inorganic components such as CO₃ and NO₃ present in soil.

5. Study of Ecosystem: (through charts/models/specimens)

- a. Ecosystems: Pond and Grassland.

Unit 2: GENETICS AND MOLECULAR BIOLOGY

1. Study of Genetic Codes through charts.
2. Study of the structure of Nucleic acid: DNA through charts or models- Watson & Crick Model.
3. Study of the structure of Nucleic acid: RNA through charts or models- Watson & Crick Model.
4. DNA Replication through charts or models.
5. Protein Synthesis through charts or models.
6. Genetic problems based on Monohybrid and Dihybrid Cross examples.

Unit-3 PLANT DIVERSITY: Study of lower plants

1. Study of Microscopes:

- a. Structure of dissecting microscope.
- b. Structure of compound microscope.

2. Study of Algae-

I) **Chlorophyta:**

i). *Spirogyra*

- a. Mounting- Thallus, conjugation types
- b. Permanent slides - Thallus and conjugations

ii) *Ulva*

- a. Mounting- Thallus organization
- b. Permanent slides - Thallus and reproductive structures.

II) **Cyanophyta:**

i) *Nostoc*

- a. Mounting-Thallus structure
- b. Permanent slides- Thallus and cell structures.

ii) *Microcystis*

- a. Mounting-Thallus structure
- b. Permanent slides- Thallus and reproductive structures.

3. Study of Fungi-

i) *Mucor*

- a. Specimen- Bread/ Roti with *Mucor*
- b. Mounting- Reproductive structure- spores, sporangia
- c. Permanent slides- *Mucor* sporangia, Zygosporangia

ii) *Peronospora*

- a. Mounting- Reproductive structure- spores, sporangia
- b. Permanent slide: Sporangia, Zoospores.

4. Study of Bryophytes-*Riccia*

- a. Specimen - Thallus with Sporophyte
- b. Permanent slides – Thallus v.t.s., thallus with Antheridia and Archegonia

5. Study of Pteridophytes *Nephrolepis*

- a. Specimen- Sporophytic plant
- b. Mounting- Ramenta, Hydathode, Sporangia
- c. Permanent slides- Prothallus with Antheridia and Archegonia; T.S. leaflet passing through sorus

6. Study of well-known Indian algologist, mycologist, bryologist and pteridologist their contributions through charts and photographs.

Unit 4: MORPHOLOGY, ANATOMY OF ANGIOSPERMS AND MICRO TECHNIQUE

- 1. Study of plant morphological characters of leaf and bracts (as per theory syllabus).
- 2. Study of plant morphological characters of flower and inflorescence (as per theory syllabus)

3. Study of types of stains through charts/ppt.
4. Study of meristematic, simple, and complex tissue through Charts
5. **Study of Simple tissues using *Mentha stem* (T.S) through fresh material.**
6. **Study of Complex tissue using Maize stem (T.S) through fresh material.**
7. **Study of Xylar elements from maceration material of *Bougainvillea stem*.**

PROJECTS:

Project 1: PRACTICAL I: SESSION I

The PROJECT will be on **Genetic Model preparation**. Students will be preparing a DNA/RNA model. These are to be presented as an individual project using materials/original photographs/ original drawings/ recycled material/ best from waste material and to be presented in a creative manner.

Project 2: PRACTICAL I: SESSION II

The PROJECT will be on **Plant Morphology**. Students will study the morphological characters present in living plant specimens from the field. These are to be presented as an individual project which may contain pressed plant materials/original photographs/ original drawings presented in a creative manner.

Suggested Reading:

- Practical Botany vol. I & II By Bendre and Kumar, Rastogi Publication.
- Practical Botany by S. C. Santra, Chatterjee, and Das, New Central Book Agency.
- Experimental Plant Ecology by Pratim Kapur and Sudha Rani, CBS Publication.

MODE OF EVALUATION:

SR. NO.	EXAM PATTERN	INTERNAL EXAM		EXTERNAL EXAM	
		SESSION I	SESSION II	SESSION I	SESSION II
1	Practical/Performance	25	20	25	25
2	Attendance	0	05	00	00
	Total	25	25	25	25
	Grand Total	25+25= 50 marks		25+25= 50 marks	