ST. XAVIER'S COLLEGE (AUTONOMOUS)

AHMEDABAD

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

(EFFECTIVE FROM JUNE 2024)

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 andnutilization 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 – III of the following department under Faculty of Sciencebased on Under Graduate Curriculum Framework - 2023 to be implemented from the Academic Year 2024-25.

FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

Course	Title	Content	Hours /week	Credit
DSC-1 (Theory)	Basics of Botany III	U-1: Algae U-2: Fungi and Plant Pathology U-3: Bryophytes U-4: Pteridophytes	4 hrs	4
DSC-2 (Theory)	Basics of Botany IV	U-1: Anatomy U-2: Ecology U-3: Embryology U-4: Biochemistry	4 hrs	4
DSC-3 (Lab)	Basics of Botany Practicals-III	Practical based as per Theory syllabus Paper I and II	8 hrs	4
SEC	Microscopy and Histochemical techniques	U-I: Microscopy U-II: Histochemical techniques	2 hrs	2
MDC	Plant Biodiversity	U-1: Biodiversity: Global and India U-2: Biomes & Natural History U-3: Plant diversity U-4: 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 III

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 III (BOMC331C)	4	0	0	10 + 2 from a recognized board in any stream	Basics of Biology

LEARNING OBJECTIVES (LO)	
LO-1	To be acquainted with basic concepts of unique and general features of Algae and Fungi to their morphology and to differentiate different types of algal and fungal life cycles.
LO-2	To understand various diseases occurring in plants, their classification, life cycle, and symptoms.
LO-3	To study the classification system, morphology, anatomy, and reproduction of Bryophytes and Pteridophytes and identify the economic importance of Bryophytes.
LO-4	To study heterospory, seed habitat, and Telome theory.
Course OUTCOMES (CO)	
On Completion of this course, the student will be able to	
CO-1	Understand unique and general features of Algae and Fungi concerning their morphology and will be able to differentiate different types of algal and fungal life cycles.
CO-2	Develop a critical understanding of Plant Pathology w.r.t their classification, symptoms, and disease cycles.
CO-3	Obtain an insight into the classification system, morphology, anatomy,

	and reproduction of Bryophytes and appreciate the economic importance of Bryophytes.
CO-4	Understand the classification, morphology, anatomy, and reproduction of selected pteridophytes and create a knowledge base understanding of various development processes

Unit: I: ALGAE **(15L)**

1. General Account of: -
   a. Phaeophyta
   b. Rhodophyta

2. Life history of the following genera including morphology and excluding development: -
   a. Oscillatoria
   b. ***Acetabularia***
   c. Ectocarpus
   d. Batrachospermum

Unit II: FUNGI AND PLANT PATHOLOGY **(15L)**

1. **General account of Oomycetes.**
2. General account on Ascomycetes.
3. General account on Basidiomycetes.

4. Life histories of the following genera including morphology excluding development(Classification according to Ainsworth): -
   a. Albugo
   b. Peziza
   c. Puccinia
5. Plant Pathology: classification and symptoms of plant disease.
6. Selected Plant Diseases:
   a. Powdery mildew (*Erysiphe spp.*)
   b. Ergot disease (*Claviceps spp.*)
   c. Loose smut of wheat (*Ustilago tritici*).

Unit III: BRYOPHYTA **(15L)**

1. Outline Classification of Bryophytes as per Rothmaler (1951) and Proskauer (1957).
2. Life histories of the following with external and internal structure, excluding Development.
   a. Hepaticopsida **:** *Plagiochasma*
   b. Anthocerotopsida **:** ***Anthoceros***
   c. Bryopsida **:** *Funaria*
3. Economic importance of Bryophyta**.**

Unit IV: PTERIDOPHYTE **(15L)**

1. Classification of Pteridophytes by Reimer (1954).
2. Heterospory and seed habitat.
3. Telome Theory
4. Structure, Anatomy, Reproduction, and life history (excluding development):
   a. Sphenopsida: ***Equisetum***
   b. **Pteropsida:** ***Adiantum***

Suggestive Reading:

- Smith, Gilbert M; *Cryptogamic Botany Algae & Fungi* Volume 1; 2nd edition;McGraw-hill Book Comp. Tokyo, 1955.
- 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.
- Ainsworth, G.C.; Bisby, G.R.; Kirk, P.M. (ed.); *Ainsworth & Bisby's Dictionary of the Fungi*, 10th edition; CABI Publishing: 2008.
- Alexopoulos, Constantine J.;Mims, Charles W; *Introductory Mycology*; 3rd edition;New Delhi : Wiley Eastern Limited , 1983.
- Webster, J.1985. *Introduction to Fungi.*Cambridge University Press.
- Smith, Gilbert M; *Cryptogamic Botany Bryophyta & Pteridophyta* Volume 2; 2nd edition; McGraw-hill book Comp. Tokyo, 1955.
- Parihar, N.S.; Pteridophytes: *An introduction to Embryophyta*, Vol.II; 4th edition; Allahabad: Central Book Depot , 1962.
- Kar, Ashok Kumar;Gangulee, Hirendra Chandra; *College botany* : Volume II; 2nd edition; Kolkata : New Central Book Agency (P) Ltd , 1989, 2006.
- Singh V., Pande P.C., Jain D.K.; *A Textbook of Botany*, 4th Edition; Rastogi publications, 2013.
- Sambamurthy A.V.S.S; *A Text Book of Plant Pathology*; New Delhi: I.K.International, 2005.
- Sharma P.D.; *Plant Pathology*.; 4th edition; Meerut: Rastogi Publication, 2004.
- Singh R.S; *Introduction to Principles of Plant Pathology*; 4th edition; New Delhi:Oxford and IBH, 2009.
- Smith, Gilbert M; Cryptogamic Botany Bryophyta & Pteridophyta Volume 2; 2nd edition; McGraw-hill book Comp. Tokyo, 1955.
- Parihar, N.S.; Pteridophytes: An introduction to Embryophyta, Vol.II; 4th edition; Allahabad: Central Book Depot, 1962.
- Kar, Ashok Kumar; Gangulee, Hirendra Chandra; College botany: Volume II; 2nd edition; Kolkata: New Central Book Agency (P) Ltd, 1989, 2006.
- Sharma, O.P. 2012; Pteridohyta; Tata McGraw Hill Education Pvt. Ltd. New Delhi.
- Singh V., Pande P.C., Jain D.K.; A Textbook of Botany, 4th Edition; Rastogi publications, 2013.
- Sporne, K.K. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd. Bombay.

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.tkdl.res.in/tkdl/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:

The 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%).

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – III of the following departments under the Faculty of Science based on Under Graduate Curriculum Framework - 2023 to be implemented from the Academic Year 2024-25.

FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

BSc. (Hons.) Botany

Major Course – II: Basics of Botany -IV

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 - IV (BOMC332C)	4	0	0	10 + 2 from a recognized board in any stream	Basic Knowledge of Biology

LEARNING OBJECTIVES (LO)	
LO-1	To study plant tissues concerning their internal organs and for normal and anomalous secondary growth.
LO-2	To develop a critical understanding of the evolution of the concept of the organization of the shoot and root apex and to appreciate the diversity in the structure and distribution of stomata.
LO-3	To understand core concepts of soil science and will develop an insight into ecological adaptation.
LO-4	To understand the structures of plant communities and analyze vegetative development.
LO-5	To explain the structure and development of the Embryo, the male and female gametophytes, and develop an understanding of the process of pollination.
LO-6	To classify enzymes, carbohydrates, proteins, and lipids and to analyze the structure, functions, and properties of Enzymes and

	proteins
Course OUTCOMES (CO)	
On Completion of this course, the student will be able to	
CO-1	Study plant tissues concerning their internal organs and to normal and anomalous secondary growth.
CO-2	Develop a critical understanding of the evolution of the concept of the organization of the shoot and root apex and appreciate the diversity in the structure and distribution of stomata.
CO-3	Understand core concepts of soil science and will develop an insight into ecological adaptation.
CO-4	Understand structures of plant community and analyze vegetative development.
CO-5	Explain the structure and development of the Embryo, the male and female gametophyte, and develop an understanding of the process of pollination.
CO-6	Classify enzymes, carbohydrates, proteins, and lipids and will be to analyze the structure, functions, and properties of Enzymes and proteins

Unit I: ANATOMY **(15L)**

1. Classification and theories of root and shoot apex.
2. Types of Vascular Bundles
3. Stellar Evolution and Types of Steles.
4. Mechanical Tissue System (e.g. Sunflower root, *Nyctanthes* Stem and Maize Leaf)
5. Normal Secondary Growth (Sunflower root, Sunflower Stem/ *Capparis* Stem).
6. Anomalous Secondary Growth (*Salvadora* Stem).
7. Stomata: Distribution, Structure and Types; Stomatal index.

Unit II: ECOLOGY **(15L)**

1. Edaphic factors:
  a. Composition of soil,
  b. Origin and development of soil,
  c. Soil moisture,
  d. Soil profile,
  e. Soil erosion
  f. Soil conservation.
2. Ecological adaptation in Hydrophytes and Xerophytes.
3. Vegetation development: Causes and types of succession: Mechanism of ecological succession;Changes in ecosystem properties during succession; Hydrosere, Xerosere.
4. Structure of Plant Communities; Methods of studying plant communities: Analytical and Synthetic characters of plant community; Raunkiaer's life forms, Biological Spectrum.

Unit III: EMBRYOLOGY **(15L)**

1. Structure & Development of microsporangium and male gametophyte.
2. Structure of ovule and types of ovules.
3. Structure & Development of megasporangium and female gametophyte. Monosporic, Bisporic, Tetrasporic (Fritillaria type).
4. Pollination: Definition, Types and Agents.
5. Pollination in Salvia and Calotropis.
6. Development of Dicot and Monocot Embryo.

UNIT IV: BIOCHEMISTRY **(15L)**

1. pH and Buffer.
2. Protoplasm as a colloidal system.
3. Classification & types of Carbohydrates and Lipids.
4. Enzymes:
- **a.** Definition.
- **b.** Nomenclature and classification of enzymes.
- **c.** Properties of enzymes.
- **d.** Mechanism of enzyme action.
- **e.** Factors affecting enzyme activity.

Suggestive Reading: -

- Eames, Arthur J.; MacDaniels, 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.
- Gangulee, Das, and Dutta – College Botany Vol I.
- Fahn, A; Plant anatomy; 4th edition. Indian reprint; New Delhi: Aditya Books (P) Ltd.,
- 1990(1997).
- Tayal M.S.; Plant Anatomy; Rastogi publications, 1983.
- 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.
- Sharma, P.D.; Ecology and Environment; 7th edition; Meerut: Rastogi Publishers, 1998.
- Odum, E.; Barrick M.; Barrett G.; Fundamentals of Ecology, 5th edition; New Delhi: Cengage Learning India, Pvt. Ltd., 1971.
- Miller, G. Tyler; Textbook of Ecology, New Delhi: Cengage Learning India, 2009.
- Maheshwari, P.; Introduction to the embryology of angiosperms; 2nd edition, reprint; New Delhi: Tata Mcgraw-Hill Publishing Company Limited, 1971.
- Bhojwani, S.S.; Bhatnagar, S.P.; The embryology of angiosperms; revised edition; Delhi: Vikas Publishing House Pvt. Ltd., 1996.
- Verma S. K. Textbook of Plant Physiology and Biochemistry; 4th editon; S. Chand & Company Ltd, 2003.
- Witham, F.H., Delvin, R.M; Plant Physiology; Boston, MA:Willard Grant, 1983.
- Verma S. K. Textbook of Plant physiology and Biochemistry; 4th editon; S. Chand & Company Ltd, 2003.

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.tkdl.res.in/tkdl/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

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FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

BSc. (Hons.) Botany

Major Course – III: Basics of Botany Practicals III

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 - III (BOMC333C)	0	0	4	10 + 2 from a recognized board in any stream	Basic Knowledge of Biology, identification, observation, and Analytic skills

LEARNING OBJECTIVES (LO)	
LO-1	To identify Algae, Fungi, Bryophytes, Pteridophytes, and Plant Pathology of selected plants.
LO-2	To demonstrate experimental techniques in anatomy, embryology, and ecology (related to the syllabus).
LO-3	To perform biochemical tests related to proteins, lipids, carbohydrates, and enzymes.
LO-4	To identify various structural peculiarities related to embryology and anatomy through charts and slides.
LO-5	To participate in case studies using observation skills of ongoing topics.

Course OUTCOMES (CO)	
On Completion of this course, the student will be able to	
CO-1	Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Algae, Fungi, Bryophytes, Pteridophytes, and Plant Pathology.
CO-2	Perform the techniques in Anatomy, Embryology, and Ecology (related to the theorysyllabus).
CO-3	Perform biochemical tests related to lipids, proteins, carbohydrates, and enzymes.
CO-4	Acquire knowledge of the theoretical aspects of Embryology through permanent slides.
CO-5	Prepare a project based on case studies.

PRACTICAL PART A

1. **Study of Algae**

   a. ***Oscillatoria:*** Specimen of Thallus.
   b. ***Gloeotrichia*****:** Specimen of Thallus.
   c. ***Acetabularia*** **Mounting of vegetative structure, and study of reproductive structure through material or permanent slide/Charts**
   d. ***Volvox*****: mounting of vegetative structure, study of reproductive structure through material or Permanent slides/Charts.**
   e. ***Ectocarpus*****:** Mounting of vegetative thallus, Unilocular and Plurilocular sporangium. Permanent slides of Unilocular and Plurilocular sporangium.
   f. ***Batrachospermum:*** Mounting of the vegetative thallus, Cystocarp.Permanent slides of antheridia, archegonia and cystocarp.

2. **Study of Fungi and Plant Pathology**

   1. Fungi:
   a. ***Albugo*****: Mounting of Conidia.**
   Permanent slides or charts of the sexual mode of reproduction and T.S of leaf passing through Pustules.
   b. ***Peziza*****:** Structure and Reproductive organs.
   c. ***Puccinia*****:** Mounting of Uredospore and Teliospore.
   Permanent slides of Uredospore, Teliospore, Pycniospore and Aeciospore.

   2. Study of plant diseases as per theory syllabus
   a. Powdery mildew (*Erysiphe*)
   b. Ergot disease (*Claviceps*)
   c. Loose smut of wheat (*Ustilago tritici*)

3. Study of Bryophytes
   a. ***Plagiochasma:*** Specimen**s** of Thallus, Reproductive organs (Antheridia, Archegonia & Sporophyte).

Permanent slides or charts of the V.S. of thallus and reproductive organs.

b. ***Anthoceros:*** **Specimen of Thallus, Reproductive organs (Antheridia, Archegonia & Sporophyte).**

Permanent slides or charts of the V.S. of thallus and reproductive organs.

c. ***Funaria*****:** Mounting of Antheridia, Archegonia, Peristomal teeth. Specimen Funaria gametophyte with sporophyte.

Permanent slides of Antheridia, Archegonia, and Sporophyte.

4. **Study of Pteridophytes:**

(a) Identify and classify the following types: PTERIDOPHYTA: *Equisetum, Adiantum*

Study through permanent slides or charts: study of T.S. of stem & leaf in *Equisetum* and Leaflets (with and without Sori), Ramenta in *Adiantum*.

(b) Structure and Reproductive organs: PTERIDOPHYTA: *Equisetum, Adiantum*.

Reproductive organ exposure of *Equisetum,* and *Adiantum.*

Study through permanent slides or charts: L.S of Cone in *Equisetum*, T.S passing through *Adiantum Sori,* Prothallus of *Adiantum*.

PRACTICAL PART B

1. Anatomy

a. Permanent slides of shoot apex (*Dictyota* and *Chara*) and root apex.
b. Mounting of the shoot apex from the Hydrilla shoot.
c. Permanent slides of Sunflower stem, root, and Salvadora stem secondary growth.
d. Double stain temporary preparation of *Salvadora* stem secondary growth.
e. Distribution of Mechanical tissue from the following: Sunflower root, *Nyctanthes* stem, Maize leaf.
f. Types of Vascular bundles.
g. Types of Stele.
h. Types of Stomata.

2. Ecology

a. Water holding capacity of soil.
b. Hydrophytes- *Hydrilla, Nymphaea, Eichhornia, Trapa*.
c. Xerophytes- *Nerium, Agave, Euphorbia*.
d. Determination of Frequency (%), Density, and Abundance of plant species from a given area.
e. Study of Biological Spectrum and prediction of vegetation of a given area by comparing its biologicalspectrum to the normal.

3. Embryology

a. Study of Pollen germination through temporary mounting.
b. Permanent slide of T.S. of Anther, Pollen grain on stigma through temporary mounting
c. Permanent slides or charts of Types of Ovules.
d. Permanent slide of the female gametophyte.
e. Permanent slides of Embryo sac with MMC; 2/4/8-nucleate Embryo sac.

4. Biochemistry

a. Agar-agar (Sol & Gel).
b. Histochemical tests of Carbohydrates (Starch, Glucose, and Lignin) & Lipid.
c. Enzyme activity- amylase and Catalase.

PROJECT:

The PROJECT will be based on **Case Studies/ Experiential learning based on** topics from the **major papers I and II.** These will be presented as an individual project which may presented in the form of PPT/ Charts/ Reports etc. It should be developed and submitted in a creative manner.

Suggested Readings:

1. Bendre Ashok M.; Ashok Kumar: A Text Book of Practical Botany; Vol 1; Meerut: Rastogi Publications, 2010
2. Practical Botany vol. I & II by Bendre and Kumar, Rastogi Publication
3. Practical Botany by S. C. Santra, Chatterjee and Das, New Central Book Agency.
4. Experimental Plant Ecology by Pratima Kapur and Sudha Rani, CBS Publication

MODE OF EVALUATION:

The evaluation is divided into two parts:

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**	