

# **ST. XAVIER'S COLLEGE (AUTONOMOUS)**

## **AHMEDABAD**

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



**(EFFECTIVE FROM JUNE 2023)**

**ST. XAVIER'S COLLEGE (Autonomous),  
AHMEDABADBOTANY  
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, 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 the 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, team work 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 enquiry.

## St. Xavier's College (Autonomous), Ahmedabad

### Syllabus of Semester – II 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
<b>DSC-1 (Theory)</b>	Basics of Botany-II	U-1: Plant Resources, Gardening and Biotechnology U-2: Plant Physiology U-3: Plant Diversity: Study of Higher Plants U-4: Morphology and Taxonomy of Angiosperms.	4 hrs	4
<b>DSC-1 (Lab)</b>	Basics of Botany Practical-II	Practical based as per Theory syllabus.	8 hrs	4
<b>Minor (Theory)</b>	Fundamentals of Botany-II	U-1: Plant Diversity: Study of Higher Plants U-2: Morphology and Taxonomy of Angiosperms	2 hrs	2
<b>Minor (Lab)</b>	Fundamentals of Botany -II	Practical based as per Theory syllabus.	4 hrs	2
<b>SEC</b>	Herbarium Techniques	U-I: Introduction to Herbarium and Collection U-II: Processing and Maintenance	2 hrs	2
<b>MDC</b>	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
<b>AEC</b>		(To be offered by the concerned subject Department)		
<b>VAC</b>		(To be offered by the concerned subject Department)		

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Syllabus of Semester – II of the following departments under the 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

#### BSc. (Hons.) Botany

#### Major Course – I: Basics of Botany II

#### 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 II (BO-2501)	4	0	0	10 + 2 from a recognized board in any stream	Basic Knowledge of Biology

#### LEARNING OBJECTIVES (LO)

LO-1	To understand the use of plant resources and the basic concepts of Gardening and be acquainted with technology development in Biotechnology and Plant tissue culture.
LO-2	To gain knowledge on environmental and biological ethics.
LO-3	To understand the physiological processes of flowering, respiration and the plant-waterrelated physiological processes.
LO-4	To differentiate between Gymnosperms and Angiosperms.
LO-5	To understand the life cycles of <i>Cycas</i> , Sunflower and Maize and gain knowledge on the Morphology of Angiosperms.
LO-6	To learn about the types of classifications- artificial, Natural and Phylogenetic and know how to classify plants based on Bentham and Hooker's system of Classification

#### Course OUTCOMES (CO)

On Completion of this course, the student will be able to

CO-1	Explain the use of plant resources and learn the basic concepts of Gardening.
CO-2	Discuss the technology development in Biotechnology and Plant tissue culture.
CO-3	Explain the physiological processes of flowering plants, respiration and the plant-water-related physiological processes.
CO-4	Discuss environmental and biological ethics.
CO-5	Differentiate between Gymnosperms and Angiosperms and describe the life cycles of <i>Cycas</i> , Sunflower, and Maize.
CO-6	Discuss the types of classifications- artificial, Natural and Phylogenetic and know how to classify plants based on Bentham and Hooker's system of Classification.

### Unit-1 PLANT RESOURCES, GARDENING AND BIOTECHNOLOGY (15L)

#### 1. PLANT RESOURCES:

Botanical name, common name, family, useful part, brief description, important chemical constituents if any, climate and cultivation (only for cereals, pulses and oil seeds) and uses of the following plants:

- a. Cereals- Wheat, Rice
- b. Pulses- Gram.
- c. **Oil Seeds- Groundnut**
- d. Medicinal plants- Ginger, Aloe, Neem and Ashwagandha

#### 2. GARDENING:

- a. Types of gardens (Kitchen Garden, water garden, rock garden and terrace garden)
- b. Garden Operations- digging, planting.
- c. Identification of common plants for different garden locations. (Minimum 5 plants for each location): paths, avenues, hedges and flower beds.

#### 3. BIOTECHNOLOGY:

- a. Introduction, Brief History, Scope, and Types of Plant Biotechnology.
- b. Plant Tissue Culture – Tools & Technique; Applications

#### 4. BIOETHICS: Introduction to Bioethics.

### Unit-2: PLANT PHYSIOLOGY (15L)

#### 1. Plant-Water Relations:

- a. Water Potential
- b. Diffusion,
- c. Imbibition,
- d. Osmosis,
- e. Plasmolysis

#### 2. Physiology of Flowering:

- a. Role of temperature in flowering (Vernalization)
- b. Role of light in flowering (Photoperiodism)

#### 3. Respiration

- a. Outline of Respiratory metabolism.
- b. Glycolytic pathway.
- c. Oxidative Pentose Phosphate Pathway.

- d. Anaerobic respiration.
- e. Tricarboxylic Acid Cycle.
- f. Respiratory Chain/ETS
- g. Significance of ATP.
- h. Chemiosmotic theory.

**Unit-3: PLANT DIVERSITY: Study of higher plants****(15L)****GYMNOSPERMS**

1. General characters of Gymnosperms: occurrence, morphology and reproduction.
2. *Cycas*: Occurrence, distribution, taxonomic position, morphology, reproduction and life history of the genus (excluding anatomy).

**ANGIOSPERMS**

1. General characters of Dicotyledons and Monocotyledons.
2. Sunflower and Maize: Occurrence, distribution, taxonomic position, morphology, reproduction and life history of the genus (excluding anatomy).

**Unit-4 MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS****(15L)**

1. MORPHOLOGY OF ANGIOSPERMS
  - a. Stipules: types and modifications.
  - b. Types of placentation.
  - c. Types of aestivations.
2. TAXONOMY OF ANGIOSPERMS
  - a. Introduction to systems of classification—Artificial, Natural and Phylogenetic.
  - b. Bentham and Hooker's system of classification. **Merits and Demerits.**
  - c. Study of the following families.
    - i.) Dicotyledons- Polypetalae – *Malvaceae*
    - ii) Dicotyledons- Gamopetalae- *Convolvulaceae*
    - iii) Dicotyledons- Apetalae- *Nyctaginaceae*
    - iv) Monocotyledons- *Amaryllidaceae*

**Suggestive Reading:**

- Verma V.; Text Book of Economic Botany; Delhi: Ane Books, 2009.
- Kochhar S.L., Elbaum L., Einstein E.; Economic Botany in the Tropics; Pan MacMillan, 2012.
- Hill A.F.; Economic Botany, 2<sup>nd</sup> Edition; New York: McGraw -Hill, 1992.
- Samba Murty A.V.S.S., Subramanyam N.S.; Economic Botany of Crop Plants; Asia tech Publishers, 2000.
- Mukherjee D., Bose T.K.; Percy Lancaster's Gardening in India; India Book House Pvt Ltd., 1997.
- Futehally Laeeq; Gardens, 2<sup>nd</sup> Edition; New Delhi: National Book Trust, 1990.
- Satyanarayana U.; Biotechnology; Books and Allied (P) Ltd, 2005.
- Gupta P.K.; Elements of Biotechnology; Rastogi Publications, 2009.
- Narayanaswamy S.; Plant cell and tissue culture; Tata McGraw Hill, 2011.
- Bhojwani, S.S.; Plant Tissue Culture: Theory and Practical (a revised edition). New York, USA: Elsevier Science Publishers, 1990.

- Ignacimuthu S.; Basic Biotechnology; Tata McGraw Hill, 1995.
- Dubey, R.C.; Text Book of Biotechnology; S.Chand Ltd, 2001.
- Noggle, Ray G.; Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi:Prentice-Hall Of India Private Limited, 1991.
- Sinha, B.K; Pandey, S.N.; Plant Physiology; 1st edition; New Delhi: Vikas PublishingHouse Pvt. Ltd., 1981.
- Verma, V.; Textbook of plant physiology; New Delhi: Ane Books India, 2007.
- Salisbury, Frank B.; Ross, Cleon W.; Plant physiology; 3rd edition, Reprint; New Delhi:CBS Publishers & Distributors, 1986(2001).
- Devlin, Robert M.; Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint;Delhi: CBS Publishers & Distributors, 1986(2001).
- Kochhar, P.L.; A textbook of Plant Physiology; 7th edition; Delhi: Atma Ram & Sons,1964.
- Verma S. K. Textbook of Plant physiology and Biochemistry; 4th editon; S. Chand &Company Ltd, 2003.
- Salisbury, Frank B.;Parke, Robert V.; Vascular plants : form and function; London :Macmillan & Co Ltd , 1964.
- Sinha, R.K.; Modern plant physiology; 2nd edition; New Delhi :Narosa Publishing House 2004.
- Ganguly A.K., Kumar N.C.; General Botany, Vol II, Part II: Introduction to plant physiology; 7<sup>th</sup> Edition; Emkay Publications, 1990.
- Chamberlain, Charles Joseph;Coulter, John Merle; Morphology of Gymnosperms; 2ndedition; Allahabad : Central Book Depot , 1964.
- Chamberlain, Charles Joseph; Gymnosperms: structure and evolution; 2nd edition; NewYork : Dover Publications, Inc. , 1966.
- Bhatnagar, S.P.;Moitra, A.; Gymnosperms. ., New Delhi : New Age International Pvt.Ltd., 1996.
- Raghavan, V.;Developmental Biology of Flowering plants; New York: Springer - Verlag,1999.
- Vasishtha P.C.;; Botany for degree students- Vol. V, Gymnosperm; Delhi: S. Chand, 1983.
- Chopra G.L., Nagin S.; Gymnosperm; Jullundhar: S. Nagin& Co., 1978.
- Dutta, A.C.; A Class-book of Botany; 15th edition; Calcutta: Oxford University Press,1976.
- 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 PublishingHouse Pvt. Ltd. , 1995.
- Lawrence, George H.M.; Taxonomy of Vascular Plants; 1st edition; New Delhi : Oxford& IBH Publishing Co., 1967.
- Sharma, O.P.; Plant Taxonomy; 1st edition, reprint; New Delhi : Tata McGraw-HillPublishing Co. Ltd. , 1993(2002)
- Esau, Katherine; Anatomy of seed plants; 2nd edition; New York : John Wiley & Sons,1977.
- Gangulee, H.C., Das, K.S., Dutta C.T.; College Botany Vol I.; Kolkata: New CentralBook Agency, 2002.
- Naik, V.N. 1984. *Taxonomy of Angiosperms*; New Delhi: Tata McGraw - Hill PublishingCo. Ltd., 1984.

### **Suggested Online Links/Readings:**

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<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.tkd.l.res.in/tkd/langdefault/common/Home.asp?GL=Eng>

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

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

[www.ncert.in](http://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.
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%).



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### FACULTY OF SCIENCE

### DEPARTMENT OF BOTANY

#### BSc. (Hons.) Botany

#### Major Course – II: Basics of Botany Practicals- II

#### 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 - II (BO-2502 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 learn economic botany, garden tools, instrumentation, plant tissue culture, Laboratory design and herbarium technique through cards.
LO-2	To demonstrate experimental techniques related to plant physiology.
LO-3	To perform experimental techniques to analyze selected plants from Gymnosperm and Angiosperm.
LO-4	To understand the distinguishing features and classification of selected Angiosperm families and learn to appreciate their economic importance.

LO-5	To prepare a project on the Career opportunities available in any of the branches of Biology and document florist records of the selected area.
<b>Course OUTCOMES (CO)</b>	
On Completion of this course, the student will be able to	
CO-1	Identify economically important plants, garden tools, and instrumentation and illustrate, plant tissue culture laboratory, and garden layout design through charts and cards.
CO-2	Demonstrate experimental techniques related to plant physiology.
CO-3	Perform experimental techniques to analyze selected plants from Gymnosperm and Angiosperm.
CO-4	Describe the distinguishing features and classification of selected Angiosperm families and recognize to appreciate their economic importance.
CO-5	Prepare a project on the Career opportunities available in any of the branches of Biology and Studying of Florist records of the selected area.

## Unit-1 PLANT RESOURCES, GARDENING, AND BIOTECHNOLOGY

### I] Plant Resources

1. Economic Botany- Study of plants as per theory syllabus.

### II] Gardening:

1. Study of Garden tools as per theory syllabus through charts-

- i. Scissors,
- ii. Hoe,
- iii. Hose,
- iv. Clippers,
- v. Watering can,
- vi. Sprinkler.

2. Study common plants for different garden locations (5 plants each) of your area through fresh specimens and herbaria **and design of garden layout through an outline map.**

- i. Avenue
- ii. Hedge
- iii. Paths
- iv. flower beds.

### III] Biotechnology:

1. Study of Plant Tissue Culture tools through charts

- i. Laminar- Air Flow,
- ii. Autoclave,
- iii. pH meter,
- iv. Oven,

- v. Digital balance
2. **Designing of Plant Tissue Culture laboratory using outline map.**

## Unit-2: PLANT PHYSIOLOGY

- I] Experiments (to be individually performed) for
1. To study diffusion in liquid and gaseous phases.
  2. To study Endosmosis and Exosmosis in grapes.
  3. To study Osmosis using a Potato Osmometer.
  4. To study Plasmolysis using *Tradescantia* leaf.

- II] Demonstration Experiments:
1. Anaerobic respiration.
  2. Kuhne's tube.
  3. Release of CO<sub>2</sub> in anaerobic respiration.

## Unit-3: PLANT DIVERSITY: Study of higher plants

### I] Study of Gymnosperms:

1. Study of Gymnosperms- Life-History of *Cycas*
  - i. Specimen- *Cycas* whole plant, coralloid roots, compound leaf, male cone, Megasporophyll and ovules
  - ii. Mounting – *Cycas* microspores
  - iii. Permanent slides- T.S Microsporophyll, L.S Ovule

### II] Study of Angiosperms:

1. Study of Life History:
  - a. Sunflower
    - i. Specimens – Whole plant, Inflorescence, Ray floret and Disc floret.
  - b. Maize
    - i. Specimen – Whole plant, Inflorescence, Seed.
    - ii. Slides – LS of Seed.
2. **Study of internal & external Leaf characteristics of Dicotyledon *Ixora* sps. and Monocotyledon *Crinum* sps. plants.**
3. **Study of the stem characteristics of Dicotyledon *Sunflower* sps. and Monocotyledon *Maize* sps. plants.**
4. **Study of Pollen grain characteristics of Dicotyledon *Ixora* sps. and Monocotyledon *Crinum* plants sps.**

## Unit-4 MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS

- I] Study of Plant Morphology through charts and fresh specimens.
1. Study of Plant Morphology -I: Types of Placentation.
  2. Study of Plant Morphology -II: Types of Aestivation.
  3. Study of Plant Morphology -II: Types of Stipules.

- II] Study of Plant families: Classification with reasons, identifying characters (general

and distinguishing), floral formula and floral diagrams, habit, sketch, androecium, gynoecium, and T.S of the ovary; 3-4 botanical and common names of examples.

1. Study of Plant families- Dicotyledonae: *Polypetalae: Malvaceae*,
2. Study of Plant families- Dicotyledonae: *Gamopetalae: Convolvulaceae*,
3. Study of Plant families- Dicotyledonae: *Apetalae: Nyctaginaceae*
4. Study of Plant families- Monocotyledon: *Amaryllidaceae*

## PROJECTS:

### Project 1: PRACTICAL I: SESSION I

The PROJECT will be on the **Career opportunities** available in any of the branches of Biology which the student chooses to go ahead after graduation. The student will be presenting it as an individual project mentioning the opportunities at Local, State, National, and International levels for the chosen career. These particulars are to be submitted in the form of handwritten reports with photographs/creatively drawings etc.

### Project 2: PRACTICAL I: SESSION II

The PROJECT will be on the Study of **Campus flora/Visit to Serenity Botanical Garden/Riverfront Flower Show etc.** Students will study the basic plant taxonomy and learn to identify basic families of plant kingdoms. These are to be presented as individual projects in the form of Reports/ PPT etc 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.

### 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	<b>25</b>	<b>25</b>	<b>25</b>	<b>25</b>
	Grand Total	<b>25+25= 50 marks</b>		<b>25+25= 50 marks</b>	