

HSNC UNIVERSITY, MUMBAI



HSNC UNIVERSITY, MUMBAI
KISHINCHAND CHELLARAM COLLEGE

FYBSC BOTANY SYLLABUS

As per NEP 2020
Academic Year 2024-25



HSNC UNIVERSITY, MUMBAI

BOARD OF STUDIES IN FACULTIES OF SCIENCE & TECHNOLOGY

BOARD OF STUDIES IN BOTANY SUBJECT

- 1) **Name of Chairperson/Co-Chairperson/Coordinator: -**
 - a. Dr. Suvarna Sharma (Assistant Professor, Department of Life Sciences, K C College)
- 2) **Two to five teachers each having a minimum of five years of teaching experience amongst the full-time teachers of the Departments, in the relevant subject.**
 - a. Dr. Mayuresh Joshi (Assistant Professor, Department of Life Sciences, K C College)
 - b. Dr. Mona Kejriwal (Associate Professor, Department of Botany, R. D. National College)
- 3) **One Professor / Associate Professor from other Universities or professor / Associate Professor from colleges managed by Parent Body; nominated by Parent Body; -**
 - a. Dr. Aparna Saraf (Associate Professor, Department of Botany, Homi Bhabha University)
- 4) **Four external experts from Industry / Research / eminent scholars in the field relevant to the subject nominated by the Parent Body;**
 - a. Professor Dr. Sunita Shailajan (Retired Head of the Department of Botany, R. Ruia College)
 - b. Dr. Devangi Chachad (Associate Professor, Department of Botany, Jai Hind College)
 - c. Dr. Pallavi Latkar (Environmental Architect, Grassroots Pvt. Ltd)
 - d. Dr. Shilpa Vora (Head, R & D, Global Lifebuoy and Skin cleansing)
- 5) **Top rankers of the Final Year Graduate and Final Year Post Graduate examination of the previous year of the concerned subject as invitee members for discussions on framing or revision of the syllabus of that subject or group of subjects for one year.**
 - a. Mr. Sumeet Kabra (Entrepreneur, NewYou – Education Consultant)
 - b. Mr. Atul Kotian (Research fellow, University of Buffalo)



PART 1

Part 1- Preamble

Plants are an integral and important part of Earth's biosphere and are essentially one of the driving forces of evolution. Human development is closely interlinked with the plant-human interactions. Therefore, the knowledge of plant systems is essential as a basic unit of study in Biological Sciences. Study of plant diversity, morphology, anatomy, and economic importance at the undergraduate level, would give the students, an insight about the importance of plants as a major component of our ecosystem.

This course has one paper covering theory and practicals per semester. With the introduction of the Choice Based Grading System, there will be a continuous evaluation throughout the year in the form of Internal Assessment and summative Assessment.

1. Program Outcomes

- a. **Disciplinary knowledge and skills:** Learner shall be capable of demonstrating comprehensive knowledge and understanding of major concepts, theoretical principles, and experimental findings in Botany, its different subfields, and other related fields of study, including broader interdisciplinary fields such as System Biology, Physiology, Ecosystem studies, etc. along with the ability to use modern instrumentation for understanding biological phenomenon.
- b. **Skilled communicator:** Learner shall be able to transmit complex technical/scientific information in the field of Biological Sciences clearly and concisely in writing and oral skills.
- c. **Critical thinker and problem solver:** The learners shall be able to employ critical thinking and efficient problem-solving skills in various areas of Biology.
- d. **Ethical awareness and reasoning:** The learner shall learn to avoid unethical behavior such as fabrication, forgery, or misrepresentation of data or committing plagiarism, and appreciate environmental and sustainability issues.
- e. **Lifelong learners:** The learner shall be capable of self-paced and self-directed learning aimed at personal development and improving knowledge/skill development and reskilling.

2. Course Objectives

- a. **To elucidate** a strong basis of classical botany, along with applications, extensions, and relevance of the subject to all other living organisms.
- b. **To ascertain holistic coverage** of the subject, rooted in a realistic approach with practical applications of theoretical concepts and generous exposure to fieldwork.
- c. **To equip graduates** of the course with the necessary and essential skill-sets as per industrial and academia requirements as well as enable students to earn expertise in botany-related careers.
- d. **To provide alluring, interesting, and rewarding career options** to the students at the undergraduate level.



- e. **To empower young minds** to have adequate expertise in reflective thinking, rational skepticism, scientific temperament, and digital literacy so that they are equipped to contribute to contemporary scientific queries and fight immediate social issues apropos to the Indian milieu.

3. **Process Adopted for Curriculum Designing**

- a. Curriculum has been developed by maintaining a student-centric, hands-on experience-oriented learning pedagogical approach, which has been further aimed at being outcome-oriented and curiosity-driven.
- b. Using a creative and bloom-based approach, 'learning-by-rote' has been avoided and the imaginative abilities of the students have been encouraged by the designed curriculum to be more inclined towards concept clarity and self-discovery of studies.
- c. Feedback from various stakeholders, including the students, subject experts, parents, alumni, and industry partners, has been actively sought and considered to keep the syllabus updated.
- d. Modifications and changes have been made in the syllabus concerning the current needs and requirements of professionals in industry and academia.

3. **Salient features, and how it has been more relevant:**

- a. The syllabus aims to initiate a dialogue about plants and their significance in various walks of human life rather than just being a didactic monologue on mere theoretical concepts.
- b. It aims at a more applicative approach to the subject wherein the classical and theoretically driven topics have been reimagined to make them more relevant to students such as linking the topics to current climatic conditions and the impact of ecosystems on plant diversity.
- c. The Vocational Course of the subject aims to strengthen the instrumentation and technical know-how of the students in the field of Botany.
- d. Latest topics of medicinal botany, paleobotany, anatomical and anthological studies, etc. have been added in both theory and practical components to encourage core competencies and discovery-based learning in students.
- e. Syllabus would provide sufficient competency in the field for the students to undertake further discipline-specific studies and target domain-related employment opportunities.

4. **Learning Outcomes:**

- a. **Students will understand** the gradual evolution of plants and also the role of plants in evolution by studying plant diversity and lifecycles.
- b. **Students will be able to obtain knowledge and understanding** regarding various topics such as Anthology, Cell Biology, Genetics, Plant Physiology, Palaeobotany etc.
- c. **Students will be able to identify and analyze** various angiosperms and scrutinize plant morphological and anatomical features.



- d. **Students will be able to interpret genetics and biostatistics data and comment on the results obtained from the analysis.**
- e. **Students will be able to evaluate the economic and medicinal utilization of plants and explore entrepreneurial avenues in the field.**

5. Input from stakeholders:

- a. Based on the inputs from stakeholders, more relevant and trending topics have been included.
- b. More hands-on and skill-based practical sessions have been added in the syllabus including the addition of more technique-oriented experiments in VOC.
- c. In view of medicinal botany as an important branch from future career prospects, phytochemistry, active principles and testing of all metabolites is incorporated in practical.
- d. The Syllabus prepared under NEP has been made to be more inclined towards the expectations of Industry and Academia.
- e. More engaging and explorative Entrepreneurial Avenues have been added in the syllabus which also include product conceptualization, product design and product development.



**Part 2 - The Scheme of Teaching and Examination
Semester – I and Semester II**

Sr. No.	Choice Based Credit System		Subject Code	Remarks
1	Core Course (Botany)		US-FBO-101 US-FBO-P1 US-FBO-201 US-FBO-P2	-
2	Elective Course	Discipline Specific Elective (DSE) Course		-
		2.1	Interdisciplinary Specific Elective (IDSE) Course / VOC	Botany VOC 1 Botany VOC 2
		2.2	Dissertation/Project	-
		2.3	Generic Elective (GE) Course	Horticulture and Gardening
3	Ability Enhancement Courses (AEC)			-
4	Skill Enhancement Courses (SEC)		-	-

**First Year Botany Semester – I
Units – Topics – Teaching Hours**

Sr. No	Subject Code	PLANT SCIENCES - I		Hours/ Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	BOT 101B	I	Plant Diversity – I	15	45 L	3	60
		II	Morphological and Anatomical Studies	15			
		III	Genetics and Biostatistics	15			
2	BOT 101D	I	Practical Based on Semester I	30	15 x 2 = 30P	1	40
			TOTAL			4	100
<ul style="list-style-type: none"> Lecture Duration – 60 Minutes One Credit =15 Classroom Teaching Hours 							

**First Year Botany Semester – II
Units – Topics – Teaching Hours**

Sr. No	Subject Code	PLANT SCIENCES - II		Hours/ Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	BOT 102B	I	Plant Diversity – II	15	45 L	3	60
		II	Plant Physiology and Cell Biology	15			
		III	Medicinal Botany	15			
2	BOT 102D	I	Practical Based on Semester II	30	15 x 2 = 30P	1	40
			TOTAL			4	100
<ul style="list-style-type: none"> Lecture Duration – 60 Minutes One Credit =15 Classroom Teaching Hours 							



BOTANY SEMESTER I
PLANT SCIENCES – I
BOT 101B

Unit	Details	Lectures
I	Plant Diversity – I	(15L)
	1. Introduction to plant classification 1.1. General Features of Algae, Bryophytes and Fungi	5L
	2. Study of Life Cycle: 2.1. <i>Nostoc</i> 2.2. <i>Spirogyra</i> 2.3. <i>Rhizopus</i> 2.4. <i>Riccia</i>	2L 2L 2L 2L
	3. Comparative study of plant classification regarding Evolution	1L
	4. Impact of Climate change and Ecosystem destruction on Cryptogams	1L
II	Morphological and Anatomical Studies	(15L)
	1. Taxonomy and Systemic Botany	3L
	2. Essential and Non-Essential Floral Whorls	2L
	3. Primary Structure of Monocots and Dicots 3.1. Roots, Stem, Leaves and Stomata	4L
	4. Simple, Complex and Meristematic Tissues	1L
	5. Adcrustation and Incrustation	2L
	6. Ergastic Substances	2L
	7. Epidermal outgrowths	1L
III	Genetics and Biostatistics	(15L)
	1. Mendelian Genetics	3L
	2. Post Mendelian Interactions 2.1. Incomplete Dominance and Co-dominance 2.2. Multiple Allelism 2.3. Epistatic Interactions - Dominant and Recessive Epistasis 2.4. Linkages and Crossing Over	7L
	3. Biostatistics calculations – mean, median and mode 4. Calculation of standard deviation, frequency distribution 5. Graphical representation, frequency polygon, Histogram, Pie chart	5L

**Self-Learning Component**

Plant Diversity – I <ul style="list-style-type: none">- Geographical Distribution of Algae- Geographical Distribution of Fungi- Geographical Distribution of Bryophytes- Comparative Study between current and historical distribution of Plants
Morphological and Anatomical Studies <ul style="list-style-type: none">- Examples of Leaf/Tendril/Thorn/fruit/flower morphology- Structure and Functions of Simple and Complex Tissues
Genetics and Biostatistics <ul style="list-style-type: none">- Biostatistics based projects- Mendelian genetics and Examples

References

1. Ganguly and Kar, 2001. College Botany Vol I and II. Books and Allied Press Ltd. Kolkata.
2. Alexopoulos C.J., Mims, C.W. & Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley & Sons Inc.
3. Ganguly and Kar, 2001. College Botany Vol I and II. Books and Allied Press Ltd. Kolkata.
4. C. B. Powar, 2010. Cell Biology, Himalaya Publishing House.
5. P.S. Verma and V. K. Agrawal, 2008. Cell biology, genetics, molecular biology, Evolution and Ecology. S. Chand Publications, New Delhi.
6. P. J. Russel, 2010, i-Genetics, Pearson Publications. Inc.
7. M. R. Almeida, Flora of Maharashtra Vol.I – Vol III
8. Flora of Bombay Presidency – Theodor Cook Volume I, II, III
9. Sporne, K.R, 1975. The Morphology of Angiosperms, Hutchinson's University Press.
10. Textbook of Systemic Botany - By R.N.Sutaria 2nd edition



BOTANY SEMESTER II
PLANT SCIENCES – II
BOT 102B

3 Credits – 3 Units – 45 Lectures (15L X 3 Units)

Unit	Details	Lectures
I	Plant Diversity – II	(15L)
	1. Classification and the Rise of Land Plants	2L
	2. Introduction to Paleobotany 2.1. Study of <i>Rhynia</i>	2L
	3. Study of Life Cycles (General Features, Vegetative, Asexual and Sexual Reproduction and Alternation of Generation) 3.1. <i>Nephrolepis</i> 3.2. <i>Cycas</i>	8L
	4. Stellar Evolution	3L
II	Plant Physiology and Cell Biology	(15L)
	1. Ultrastructure of Chloroplast	1L
	2. Photosynthesis – C3, C4 and CAM	5L
	3. Photorespiration	2L
	4. Introduction to Plant Immune Systems	2L
	5. General Structure of Cell wall and Plasma membrane 5.1. Lipid bilayer 5.2. Fluid Mosaic Model 5.3. Membrane Proteins and their Functions	2L
	6. Ultrastructural Studies: Mitochondria and ER	2L
	7. Cell Membrane and Cellular Transport	1L
III	Medicinal Botany	(15L)
	1. Traditional Systems of Medicine in India	2L
	2. Pharmacopoeia and its relevance to quality control of Herbal Drugs	2L
	3. Concept of Primary and Secondary Metabolites	2L
	4. Pharmacognosy and Phytochemistry 4.1. Concept and overview 4.2. Active principles with examples 4.3. Qualitative testing of – alkaloids, steroids, tannins, glycosides, and volatile oils	6L
	5. Traditional Knowledge – Tulsi, Neem, Adulsa, Turmeric, Ginger, Aloe vera	3L



Self-Learning Component

Plant Diversity – II <ul style="list-style-type: none"> - Significance of Fossil Studies to Evolution - Economic and Ecological Importance of Pteridophytes and Gymnosperms - Geological Time Line
Plant Physiology and Cell Biology <ul style="list-style-type: none"> - Endosymbiont Theory - Cell wall – a comparative study across plant groups - Comparative note on of SER and RER/ Mitochondria and Chloroplast
Medicinal Botany <ul style="list-style-type: none"> - AYUSH Ministry – Current Work of AYUSH - Information on Products released by AYUSH - Quality testing of Secondary Metabolites

References

1. B. P. Pandey, 2001. Plant Anatomy. S. Chand Publications, New Delhi
2. Forester, A.S. 1960. Practical Plant Anatomy. D. Van Nostrand Company Inc.
3. Mauseth, J.D. 1988. Plant Anatomy - The Benjamin Cumming Publishing Co.
4. B. P. Pandey, 2001. Plant Anatomy. S. Chand Publications, New Delhi
5. Noggle and Fritz, 2002. Introduction to Plant Physiology, Prentice Hall Publisher
6. Lincoln Taiz and Eduardo Zeiger, 2002. Plant Physiology 2nd edition, Sinauer Associates, Inc. Publishers Sunderland, Massachusetts.
7. Salisbury and Ross 2002. Plant Physiology 3rd edition CBS publishers and distributors.
8. Quality standards of medicinal plants (ICMR, New Delhi) Vol: 1-11.
9. Chaudhary R.R. 1994. Herbal Medicines for human health. CBS Publishers New Delhi
10. Verma V. 2009. Textbook of Economic Botany, Ane Books pvt. Ltd.
11. Ganguly and Kar, 2001. College Botany Vol I and II. Books and Allied Press Ltd. Kolkata.



BOTANY– 1 Credit – Practical (10) - SEM I
BOT 101D

Sr	Details	
1	Study of Life Cycle – <i>Nostoc and Spirogyra</i>	1P
2	Study of Life Cycle – <i>Rhizopus and Riccia</i>	1P
3	Leaf Morphology and Inflorescence studies	1P
4	Families – Leguminosae, Malvaceae, Asteraceae and Amaryllidaceae	2P
5	Cell Inclusions and Epidermal Outgrowths	2P
6	Anatomical Studies – Monocot and Dicot – Root, Stem, Leaves and Stomata	3P

BOTANY MINOR – 1 Credit – Practical (10) - SEM II
BOT 102D

Sr	Details	
1	Study of Life Cycle - <i>Nephrolepis</i>	1P
2	Study of Life Cycle - <i>Cycas</i>	1P
3	Economic Importance on plants (Algae, Bryophytes, Pteridophytes and Gymnosperms)	1P
4	Pigment Chromatography	1P
5	Amino Acid Chromatography	1P
6	pH estimation by Anthocyanin from Purple Cabbage	1P
7	Study of Electron Micrographs – Chloroplasts, Amyloplast, ER and Nucleus	2P
8	Biostatistics (Using Manual and Software: Microsoft Excel and Minitab)	2P

Examination and Evaluation Pattern

- A) **Theory Component:** Semester End Examination for 60 marks – 120 min (2.0 h)
- **Component A** – 20 Marks – Open Book Evaluation – 40 min
 - **Component B** – 40 Marks – Summative/Descriptive Examination – 80 min
- B) **Practical Component:** Semester End Examination for 40 marks
- **Self-Learning and Evaluation (SLE)** – 15 Marks
 - **Practical Examination** – 50 marks reduced to 25 marks
 - o **Internal Component** – Performing Experiments – 30 marks
 - o **External Component** – Field Report (10 marks), Journal Submission (5 marks) and Viva (5 marks) – Total 20 Marks



VOC BOTANY
05 Practical Sessions

Semester I
BOT 103D

Sr	Details	Sessions
1	Observation of Xylem and Tracheid Architecture using Stem Maceration	2P
2	Study of Salinity Stress - Estimation of Proline content from <i>Portulaca</i> leaves	1P
3	Herbaria Preparation	2P

VOC - BOTANY
Semester II
BOT 104D

Sr	Details	Sessions
1	Observation of CAM Pathway - Estimation of Malic acid content in <i>Bryophyllum</i> (Day and Night Sample) and GOT and GPT Estimation.	2P
2	Algal Growth Analysis – Biofuel Extraction	1P
3	Growing of Microgreens using Hydroponics	2P