Deccan Education Society's

Fergusson College (Autonomous) Pune

Learning Outcomes-Based Curriculum

for 3/4 years B.Sc /B.Sc (Honours) Programme

as per guidelines of

NEP-2020

for

F. Y. B. Sc. (Botany)

With effect from Academic Year

2024-2025

Program Outcomes (POs) for B.Sc.	
PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of an graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
PO2	**tical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**al competence:** Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	**Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Performing dependently and also collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PSO No.	Program Specific Outcomes (PSOs) Upon completion of this programme the student will be able to
PSO1	**Academic competence:** (i) Recall classical botany concepts, state principles and outline processes underlying the field of botany and its related interdisciplinary subjects. (ii) Demonstrate an understanding of plant morphology, anatomy, physiology and application of economic botany and biotechnology. (iii) Executes botanical excursions for studying plant diversity, taxonomic identification and preparation of digital herbarium.
PSO2	**Personal and Professional Competence:** (i) Carry out group and individual activities for personal development and leadership qualities. (ii) Analyse the importance of plants and their conservation (iii) Formulate ideas, effective presentation and communication skills. (iii) Implement self-learning, discipline and problem-solving ability.
PSO3	**Research Competence:** (i) Apply appropriate techniques for solving and analysing research problems (ii) Integrate knowledge of vital and applied aspects of botany for designing experiments and interpretation of results. iii) Assess fundamental problems and provide solutions for betterment of society.
PSO4	**Entrepreneurial and Social competence:** (i) Employ the industrial applications of botany for start-up venture. (ii) Associate the impact of human activity on nature, importance of plant diversity and its conservation for sustainable development. (iii) Execute effective communication ability, presentations skills and report writing.

Fergusson College (Autonomous), Pune

NEP 2.0 Subject Credit Distribution Structure 2024-25

Department 0f Botany

FYBSc Sem -I	Theory/ Practical	Paper Code	Paper Title	Credits	Exam type
Discipline Specific Core, DSC-1	Theory	BOT-1001	Plant Diversity	2	CE +ESE
Discipline Specific Core, DSC-2	Practical	BOT-1011	Botany Practical- 1	2	CE +ESE
Open Elective-1 (For other faculty)	Theory	BOT-1021	Plants in Daily Life	2	Only CE

FYBSc Sem -II	Theory/ Practical	Paper Code	Paper Title	Credits	Exam type
Discipline Specific Core, DSC-3	Theory	BOT-1002	Plant Morphology and Anatomy	2	CE +ESE
Discipline Specific Core, DSC-4	Practical	BOT-1012	Botany Practical-2	2	CE +ESE
Open Elective-2 (For other faculty)	Theory	BOT-1022	Plants in Human Welfare	2	Only CE
Skill Enhancement Course, SEC-1	Theory/ Practical	BOT-1032	Capturing Plant Diversity in Nature	2	Only CE

Head

Department of Botany

F. Y. B. Sc. Semester I		
BOT-1001	**Plant Diversity (DSC-1)**	**Credits:** 2 **Hours:** 30
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Recall different groups of plant kingdoms based on characteristic features with examples.	
CO2	Classify various plant forms based on salient features.	
CO3	Illustrate the life cycle of different taxonomic forms.	
CO4	Analyzing the economic significance of various groups.	

Unit No.	Title of Unit and Contents	CO	Weightage in %
I	**Plant Diversity** 1.1 Introduction 1.2 Importance 1.3 General classification of plant kingdom	CO-1,2	8
II	**Algae** 2.1 General characters 2.2 Economic importance of algae 2.3 Life cycle of *Spirogyra*	CO-1,2,3,4	16
III	**Fungi** 3.1 General characters 3.2 Economic Importance 3.3 Life cycle of *Rhizopus*	CO-1,2,3,4	16
IV	**Lichens** 4.1 General characters of lichens 4.2 Types of Lichens based on thallus morphology	CO-1,2	7
V	**Bryophyta** 5.1 General characters 5.2 Economic importance of bryophytes 5.3 Life cycle of *Riccia*	CO-1,2,3,4	15
VI	**Pteridophyta:** 6.1 General characters 6.2 Economic importance of pteridophytes 6.3 Life cycle of *Nephrolepis*	CO-1,2,3,4	15
VII	**Gymnosperms** 7.1 General characters 7.2 Economic importance of gymnosperms 7.3 Life cycle of *Cycas*	CO-1,2,3,4	15
VIII	**Angiosperms** 8.1 General characteristics 8.2 Life Cycle Pattern in Angiosperms	CO-1,2	8

Resources:

1. Kumar, H.D. (1999). Introductory Phycology, 2nd edition. New Delhi, Delhi: AffiliatedEast-West Press.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory

Mycology, 4thedition. Singapore, Singapore: John Wiley & Sons.

3. Webster, J., Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge, U.K.:Cambridge University Press.
4. Sharma, O.P. (1992). Textbook of Thallophytes. McGraw Hill Publishing Co. NewDelhi.
5. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). Bryophyta, S. Chand. Delhi, India.
6. Parihar, N.S. (1976). Biology and Morphology of Pteridophytes. Central Book Depot.
7. Sharma, O.P. (1990). Textbook of Pteridophyta. McMillan India Ltd. New Delhi
8. Pandey, B.P. (2010). College Botany Vol II. S. Chand and Company Ltd., New Delhi,India.
9. Sporne, K.R. (1965). The Morphology of Gymnosperms. Hutchinson & Co., Ltd.,London.

E-resources

1. https://nptel.ac.in/courses/102/107/102107075/
2. http://hhh.gavilan.edu/rmorales/documents/Gymnosperm18_withgneto.ppt

F. Y. B. Sc. Semester I		
BOT- 1011	**Botany Practical-1** **(DSC-2)**	**Credits:** 2 **Hours:** 30
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe the vegetative and reproductive structure of the forms studied.	
CO2	Classify the different plant forms into their respective groups based on their thallus structure and reproduction.	
CO3	Classify the group and differentiate the taxonomic forms.	
CO4	Identify Life cycle patterns of various groups	
CO5	Justify the life cycle patterns of different groups to their scientific classification.	
CO6	Write a tour report and submit photos representing plant diversity.	

Practical No	Title of Practical
1	Study of vegetative and reproductive structures of *Spirogyra*.
2	Study of asexual stage and sexual structure of *Rhizopus*.
3	Lichens: a. Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. b. Study of thallus and reproductive structures (soredia and apothecium)
4	Study of vegetative and reproductive structures of *Riccia*.
5	Study of vegetative and reproductive structures of *Nephrolepis*.
6	Study of vegetative and reproductive structures of *Cycas*.
7	Study of angiosperms for habit diversity.
8	Study of angiosperm for habitat diversity
9	Field visit to study plant diversity in nature.
10	Project report and photo submission of plant diversity studied in nature.

F. Y. B. Sc. Semester I		
BOT-1021	**Plants in daily life** **(OE-1)**	**Credits: 2** **Hours: 30**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	State the economic importance of diverse plants that offer resources to humans.	
CO2	Categorize different habits of plants and their parts in day-to-day life activities.	
CO3	Classify plants according to their economic value.	
CO4	Identify the importance of plants and their nutritional value.	

Unit No.	Title of Unit and Contents	CO	Weightage in %
I	**Plants: Necessity of Life**. 1.1 Diverse uses of plants 1.2 Centre of origin	CO-1	10
II	**Study of plants with reference to the common name, habit, part used nutritional value and economic importance** 2.1 Cereals- Wheat, Rice and Maize 2.2 Millets- Jowar, Bajra, Raagi	CO-2,3,4	10
III	**Pulses** 3.1 Chickpea 3.2 Pigeon Pea 3.3 Cowpea	CO-2,3,4	10
IV	**Sugar** 4.1 Sugar cane 4.2 Sugar beet 4.3 Palm Sugar 4.4 Stevia	CO-2,3,4	10
V	**Spices** 5.1 Clove 5.2 Black pepper 5.3 Cardamom 5.4 Cinnamon	CO-2,3,4	10
VI	**Beverages** 6.1 Tea 6.2 Coffee 6.3 Cocoa	CO-2,3,4	10
VII	**Oils** 7.1 Ground nut 7.2 Sunflower 7.3 Mustard 7.4 Coconut	CO-2,3,4	10

VIII	**Vegetables** 8.1 Carrot 8.2 Potato 8.3 Tomato 8.4 Spinach	CO-2,3,4	10
IX	**Fruits** 9.1 Orange 9.2 Amla 9.3 Mango 9.4 Banana	CO-2,3,4	10
X	**Fibers** 10.1 Cotton 10.2 Jute 10.3 Coconut	CO-2,3,4	10

Resources:

1. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
2. Kochhar, S.L. (2016). Economic Botany: A comprehensive study, Fifth edition, Cambridge University Press, NY.
3. Singh, H.B. and R.K. Arora. (1978). Wild edible plants of India (1st ed.). ICAR Publication, New Delhi.
4. Wickens, G.E. (2001). Economic Botany: Principles &Practices.The Netherlands: Kluwer Academic Publishers.
5. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture.Jones& Bartlett – Publishers.
6. Pandey, B.P. (1999). Economic Botany. S. Chand, New Delhi.

E-resources:

1. https://swayam.gov.in/nd2_cec19_bt10/preview
2. https://www.swayamprabha.gov.in/index.php/program/archive/9

F. Y. B. Sc. Semester II		
BOT-1002	**Plant Morphology and Anatomy** **(DSC-3)**	**Credits:** 2 **Hours:** 30

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Define and understand the concepts and fundamentals of plant morphology.
CO2	Describe the morphology of plant parts, inflorescence, flowers, and fruits.
CO3	Interpret the concepts and fundamentals of plant anatomy
CO4	Examine the internal anatomy of plant systems and organs.

Unit No.	Title of Unit and Contents	CO	Weightage in %
I	**General organization of plant body** 1.1 Root: Characteristics, functions, modifications. 1.2 Stem: Characteristics, functions, modifications. 1.3 Leaf: Characteristics, functions, modifications.	CO-1,2	10
II	**Inflorescence** 2.1Definition and Types 2.2 Racemose: Raceme, Spike, Spadix, Umbel and Capitulum. 2.3 Cymose - Solitary, Monochasial, Dichasial and Polychasial. 2.4 Special type of inflorescence: Cyathium, Hypanthodium.	CO-1,2	15
III	**Flower** 3.1 Definition and parts of a typical flower. 3.2 Flower symmetry: Actinomorphic, Zygomorphic and Asymmetrical. 3.3 Insertion of floral whorls on the thalamus: Hypogynous, Perigynous and Epigynous. 3.4 Perianth: Calyx and Corolla, Aestivation. 3.5 Calyx modifications: Petaloid, Pappus and Spurred. 3.6 Types of Corolla: Cruciform, Papilionaceous, Infundibuliform, Bilabiate. 3.7 Androecium: Parts of a typical stamen, arrangement of	CO-1,2	30

	stamen-Polyandrous, Didynamous, Tetradynamous. 3.6 Attachment of anther: Adnate, Basifixed, Dorsifixed, Versatile. 3.7 Cohesion: Adelphy, Syngeny and Synandry. 3.8 Adhesion: Epipetalous, Epiphyllous and Gynandrous. 3.9 Gynoecium: Parts of a carpel, Types: simple (apocarpous) and compound (syncarpous). 3.10 Placentation: Definition and types.		
IV	**Fruit** 4.1 Definition, parts and types of fruit. 4.2 Simple-: Achene, Cypsela, Caryopsis, Legume, Follicle, Capsule, Drupe, Berry and Hesperidium. 4.3 Aggregate-: Etaerio of berries, achenes and follicles. 4.4 Multiple fruits: Syconus and Sorosis.	CO-1,2	15
V	**Types of tissue systems** 5.1 Definition 5.2 Meristematic tissue system: Meristem, characters and types based on position. 5.3 Classification of tissues: Simple (Parenchyma, collenchyma, sclerenchyma) and complex tissues (Xylem, Phloem). 5.4 Epidermal tissue system: Cuticle,epidermis,trichomes (uni-and multicellular, glandular and non-glandular),structure of typical stomata. 5.5 Vascular tissues: Components of xylem and phloem, types of vascular bundles.	CO-3,4	15
VI	**Internal Organization of Primary Plant Body** 6.1 Structure of dicot and monocot root. 6.2 Structure of dicot and monocot stem. 6.3 Structure of dicot and monocot leaf.	CO-3,4	15

Resources:

1.Pandey, B.P. 2009. Plant Anatomy. S. Chand and Co., Ltd., New Delhi.

2. Tayal, M.S. 1996. Plant Anatomy. Rastogi Publications. New Delhi.

3. Pandey, B.P. 2011.College Botany, Vol II. S. Chand and CO., Ltd., New Delhi.

4. Singh, V., Pandey, P.C. and Jain, D.K. 1998. Anatomy of a Seed Plant. Rastogi Publications, Meerut.

5. Gangulee, H.C., Das, K.S. and Dutta, C. 2002. College Botany, Vol I. New Central Book Agency (P) Ltd, Calcutta.

6. Katherine Esau.1965. Anatomy of seed plants, 2nd Edition. Wiley Publishing Co., New York.

7. Suan, R. F. and Eichhorn, E. 2006. Esau's Plant Anatomy: Meristems, Cells, and Tissue of the Plant Body, 3rd Edition. Wiley Publishing Co., New York.

8. Fahn, A. Plant Anatomy, 3rd Edition 1985. Pergamon Press New York.

E-resources:

1. http://virtualplant.ru.ac.za/Main/ANATOMY/prac5.html.

2. https://www.swayamprabha.gov.in/index.php/program/archive/9

3. https://www.youtube.com/watch?v=Q1VosdthSLM

4. https://www.youtube.com/watch?v=WfURKyslthI

F. Y. B. Sc. Semester II		
BOT- 1012	**Botany Practical-2** **(DSC-4)**	**Credits:** 2 **Hours:** 30
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Define and understand concepts and fundamentals of plant morphology and anatomy.	
CO2	Recognize the morphology of plant parts, inflorescence, flower and fruits.	
CO3	Sketch the anatomy of dicot and monocot root, stem and leaf.	
CO4	Examine the protective systems of plants.	

Practical No	Title of Practical
1	Study of the modifications of root, stem and leaf (Any two).
2	Study of Inflorescence: Racemose: raceme, spike, spadix, umbel and capitulum. Cymose: solitary cyme, uniparous cyme: helicoid and scorpioid, biparous cyme and multiparous cyme.
3	Study of flower with respect to perianth lobes (calyx and corolla)
4	Study of flower with respect to androecium and gynoecium.
5	Study of fruits with suitable examples: 1. Simple fruit: a. Fleshy: berry and drupe. b. Dry: Achene, Cypsella and Legume. 2. Aggregate fruit: Etaerio of follicles and berries. 3. Multiple fruit: Syconus and Sorosis.
6	Study of meristems (photographs).
7	Study of tissues (parenchyma, collenchyma and sclerenchyma), xylem and phloem (photographs).
8	Study of the internal primary structure of Monocot: root, stem and leaf.
9	Study of the internal primary structure of Dicot: root, stem and leaf.
10	Epidermal tissue system - cuticle, stomata and trichomes.
11	Local visit for understanding plant morphology.
12	Project report submission on plant morphology studied.

F. Y. B. Sc. Semester II		
BOT-1022	**Plants in human welfare** **(OE-2)**	**Credits:** 2 **Hours:** 30
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Identify the different types of plants.	
CO2	Describe the major crops grown around the world and assess their use for human consumption.	
CO3	Interpret the uses of plants for health.	
CO4	Differentiate various plants for human welfare.	

Unit No.	Title of Unit and Contents	CO	Weightage in %
I	**Introduction** 1.1 Role of plants in human welfare	CO-1	5
II	**Study of plants with respect to common name, habit, plant part used and uses:** **Plants as source of food and nuts:** 2.1 Carbohydrate- Potato, Tapioca, Sweet potato, Gum. 2.2 Protein- Mung, Rajma, Pea, Soyabean. 2.3 Dietary fiber- Isapgol, Sabja. Culinary nuts- Almond, Cashew, Walnut, Pistachio.	CO-1,2,3,4	30
III	**Plants in industry** 3.1 Paper 3.2 Rubber 3.3 Timber 3.4 Cane	CO-1,2,3,4	10
IV	**Plants as coloring agents** 4.1 Heena 4.2 Bixa 4.3 Butea	CO-1,2,3,4	10

	4.4 Indigo		
V	**Plants as perfume** 5.1 Jasmine 5.2 Lavender 5.3 Geranium 5.4 Mint	CO- 1,2,3,4	10
VI	**Plants as condiments** 6.1 Chilli 6.2 Fennel 6.3 Coriander 6.4 Cumin	CO- 1,2,3,4	10
VII	**Plants as biofuel** 7.1 Jatropa 7.2 Jojoba 7.3 Castor	CO- 1,2,3,4	10
VIII	**Plants as medicine** 8.1 Ashwagandha 8.2 Sarpagandha 8.3 Shatawari 8.4 Sadaphuli	CO- 1,2,3,4	15

Resources:

1. Textbook of Economic Botany, Verma V., Ane Books Pvt. Ltd.
2. Economic Botany in the Tropics, Kochhar, Macmillan Publisher.
3. Economic Botany: Principles and Practices, Gerald E. Wickens, SpringerPublication.
4. Plants and Society: Levetin, E and K. McMahon, 7th edition, 2016
5. Sharma O.P., 2015. Plants and Human Welfare. Pragathi Prakashan
6. S. Sundar Rajan. 2007. College Botany Vol-V, Part 1:Taxonomy and Economic BotanyHimalaya Publishing House.
7. P.Vasanth Kumar 2014. Economic Botany. Sonali Publications N
8. Food Science, B. Srilakshmi, 2007. New Age International Publishers.

E-resources

1. https://swayam.gov.in/nd2_cec19_bt10/preview
2. https://www.swayamprabha.gov.in/index.php/program/archive/9

F. Y. B. Sc. Semester II		
BOT-1032	**Capturing Plant Diversity in Nature (SEC-1)**	**Credits:** 2 **Hours:** 30
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Define fundamentals of digital/ smartphone photography technology.	
CO2	Describe digital/ smartphone camera functions and their applications.	
CO3	Employ different photographic equipment to enhance their photographic Skills and create digital resources.	
CO4	Categorize various plant forms and apply photographic skills in various Professions and entrepreneurship.	

Unit No.	Title of Unit and Contents	CO	Weightage in %
I	**Study of camera** 1.1 Study the principles and working of digital/smartphone cameras.	CO-1,2	10
II	**Microscope** 2.1 Working and handling of light microscopes – DissectingMicroscope Working and handling of light microscopes – Compound Microscope	CO-1,2	15
III	**Study of plant forms through microscopic lens** 3.1 Single-celled 3.2 Colonial forms 3.3 Filamentous forms 3.4 Multicellular forms 3.5 Complex forms	CO-3,4	15
IV	**Study of plant morphology through photographs** 4.1 Root 4.2 Stem 4.3 Leaf 4.4 Inflorescence 4.5 Flower	CO-3,4	30

	4.6 Fruit		
V	**Outdoor/ Campus Photography** 5.1 Plants 5.2 Environment 5.3 Landscapes 5.4 Cityscape.	CO-3,4	15
VI	**Project Work** 6.1 Make a portfolio of diverse landscaping patterns/ selected themes through outdoor visits.	CO-3,4	15

Resources:

1. Ang., T. (2008). Fundamentals of modern Photography. London,Mitchell.
2. Freeman Patterson “The Art of Seeing” by Key Porter Books.
3. Tim Fitzharris “Landscape Photography” Firefly Books.
4. Kelby, S. (2012). The digital photography book. Peachpit Press.
5. Langford, M., Fox, A., and Smith, R.S. (2013). Langford basicphotography:the guide for serious photographers. Amsterdam: Focal Press/Elsevier.
6. Peterson, B. (2016). Understanding exposure: how to shoot greatphotographs with any camera. AmPhoto Books.

E-resources:

1. https://www.swayamprabha.gov.in/index.php/program/archive/9