



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
2023-2024

Fergusson College (Autonomous), Pune
Proposed First Year Curriculum as per NEP 2020

Department of Botany
Structure for Major / Minor

Semester	Paper	Paper Code	Paper Title	Type	Credits
I	Major	BOT-101	Plant Diversity	Theory	4
		BOT-100	Botany Practical - 1	Practical	2
	Minor	BOT-111	Fundamentals of Plant Diversity	Theory	2
		BOT-112	Botany Practical-1	Practical	2
	OE-1	BOT-120	Plants in Daily Life	Theory	2
	OE-2	BOT-121	Plant Propagation	Theory	2
	SEC	BOT-140	Capturing Plant Diversity in Nature	Skill	2
II	Major	BOT-151	Plant Morphology and Anatomy	Theory	4
		BOT-150	Botany Practical -2	Practical	2
	Minor	BOT-160	Fundamentals of Plant Morphology and Anatomy	Theory	2
		BOT-161	Botany Practical -2	Practical	2
	OE-3	BOT-170	Plants in Health Care	Theory	2
	OE-4	BOT-171	Plants in Human Welfare	Theory	2

* OE – Open Elective, SEC- Skill Enhancement Course, VSC- Vocational Skill Course

Teaching and Evaluation (Only for FORMAL education courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	3 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Eligibility: As per the rules and regulations of Savitribai Phule Pune University (SPPU)

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	Critical Thinking and Problem solving: Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	Social 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.

F. Y. B. Sc. Semester I		
BOT-101	Plant Diversity (Major - Theory)	Credits: 4 Hours: 60
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Cite the importance and economic significance of plant diversity.	1
CO2	Distinguish different plant forms to its respective group based on characteristic features and give examples.	2
CO3	Classify the different plant groups and differentiate the taxonomic forms.	3
CO4	Compare various groups within plant diversity and segregate the groups from each other using salient features.	4

Unit No.	Title of Unit and Contents	No. of hours
I	Plant Diversity 1.1 Introduction 1.2 Importance 1.3 Aspects of plant diversity 1.4 General classification of plant kingdom	03
II	Cryptogams 2.1 Introduction 2.2 General characters 2.3 Classification (Lower and Higher cryptogams) along with examples	02
III	Algae 3.1 General characters 3.2 Pigments in algae 3.3 Food reserves 3.4 Algal flagella 3.5 Range of thallus organization 3.6 Modes of reproduction 3.7 Outline classification according to Fritsch (1945) 3.8 Role of algae in Industry and agriculture 3.9 Life cycle of <i>Spirogyra</i> and <i>Chara</i>	10
IV	Fungi 4.1 General characters 4.2 Habit (Types of mycelium) 4.3 Mode of nutrition 4.4 Modes of reproduction 4.5 Outline classification according to Alexopoulos and Mims (1979) 4.6 Role of fungi in industry, agriculture and health 4.7 Life cycle of <i>Rhizopus</i> and <i>Cystopus(Albugo)</i>	08

V	Lichens 5.1 General characters of lichens 5.2 Types of Lichens on the basis of thallus morphology 5.3 Modes of reproduction 5.4 Economic significance	03
VI	Bryophyta 6.1 General characters 6.2 Modes of reproduction 6.3 Outline classification according to Parihar (1965) 6.4 Economic importance of bryophytes 6.5 Life cycle of <i>Riccia</i> and <i>Funaria</i>	08
VII	Pteridophyta 7.1 General characters 7.2 Modes of reproduction 7.3 Outline classification according to Smith (1955) 7.4 Economic importance of pteridophytes 7.5 Life cycle of <i>Selaginella</i> and <i>Nephrolepis</i>	10
VIII	Phanerogams 8.1 Introduction 8.2 General characters 8.3 Outline of classification (Bentham and Hooker)	02
IX	Gymnosperms 9.1 General characters 9.2 Modes of reproduction 9.3 Outline classification according to Sporne (1965) 9.4 Economic importance of gymnosperms 9.5 Life cycle of <i>Cycas</i> and <i>Pinus</i>	10
X	Angiosperms 10.1 General characteristics 10.2 Habit and habitat diversity 10.3 Modes of reproduction 10.4 Life cycle pattern in Angiosperms.	04

References:

1. Jackson, R.B. (2008). *Biology*, 8th edition. San Francisco, California: Pearson Benjamin Cummings.
2. Kumar, H.D. (1999). *Introductory Phycology*, 2nd edition. New Delhi, Delhi: Affiliated East-West Press.
3. Lee, R.E. (2008). *Phycology*, 4th edition. Cambridge, Cambridge: Cambridge University Press,
4. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). *Biology of Plants*. New York, NY: W.H. Freeman and Company
5. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). *Introductory Mycology*, 4th edition. Singapore, Singapore: John Wiley & Sons.
6. Sethi, I.K. and Walia, S.K. (2011). *Text book of Fungi and Their Allies*. Noida, U.P.: Macmillan Publishers India Ltd.
7. Webster, J., Weber, R. (2007). *Introduction to Fungi*, 3rd edition. Cambridge, U.K.: Cambridge University Press.
8. Sharma, O.P. (1992). *Text Book of Thallophytes*. McGraw Hill Publishing Co. New Delhi.
9. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). *Bryophyta*, S. Chand. Delhi, India.
10. Vashista, B.R. (1978). *Bryophytes*. S Chand & Co. Ltd., New Delhi
11. Parihar, N.S. (1976). *Biology and Morphology of Pteridophytes*. Central Book Depot.
12. Smith, G.M. 1971. *Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes*. Tata Tata McGraw Hill Publishing, New Delhi.
13. Eames, A.J., (1974) *Morphology of vascular plants - Lower groups*. Tata Mc Grew-Hill Publishing Co. New Delhi, Freeman & Co., New York
14. Sharma, O.P. (1990). *Text Book of Pteridophyta*. McMillan India Ltd. New Delhi
15. Rashid, A. (1998). *An Introduction to Pteridophyta*. II ed., Vikas Publishing House, New Delh
16. Vashishta, P.C., Sinha, A.K. and Kumar, A. (2010). *Gymnosperms*, S. Chand and Company Ltd., Ramnagar, New Delhi, India.
17. Pandey, B.P. (2010). *College Botany Vol II*. S. Chand and Company Ltd., New Delhi, India.
18. Sporne, K.R. (1965). *The Morphology of Gymnosperms*. Hutchinson & Co., Ltd., London.
19. Bhatnagar, S.P. and Moitra, A. (1996). *Gymnosperms*. New Age International (P) Ltd Publishers, New Delhi, India.
20. Sharma O.P. (2013). *Plant Taxonomy*. Mc Graw Hill India.
21. Gangulee H.C., Kar, A.K. and Santra S.C. (2011). *College Botany Vol II*. 4th Edition New Central Book Agency.
22. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford and IBH Pvt. Ltd., New Delhi. 3rd edition.

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-100	Botany Practical - 1 (Major - Practical)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Describe the vegetative and reproductive structure of the forms studied.	1
CO2	Classify the different plant forms to their respective groups based on their thallus structure and reproduction.	2
CO3	Classify the group and differentiate the taxonomic forms.	3
CO4	Identify life cycle patterns of various groups.	4
CO5	Justify the life cycles pattern of different groups with respect to their scientific classification.	5
CO6	Write a field report with pictorial representation of plant diversity in nature	6

Any 12 experiments: 10 Compulsory + 1 Activity (Equivalent to Two Practical)

Practical No.	Title of the Practical
1.	Study of vegetative and reproductive structures of <i>Spirogyra</i>
2.	Study of vegetative and reproductive structures of <i>Chara</i>
3.	Study of asexual stage and sexual structure of <i>Rhizopus</i>
4.	Study of symptoms of plants infected with <i>Cystopus (Albugo)</i> ; asexual stage and sexual structures of <i>Cystopus (Albugo)</i> .
5.	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)
6.	Study of vegetative and reproductive structures of <i>Riccia</i>
7.	Study of vegetative and reproductive structures of <i>Funaria</i>
8.	Study of vegetative and reproductive structures of <i>Selaginella</i>
9.	Study of vegetative and reproductive structures of <i>Nephrolepis</i>
10.	Study of vegetative and reproductive structures of <i>Cycas</i>
11.	Study of vegetative and reproductive structures of <i>Pinus</i>
12.	Study of angiosperms with respect to habit
13.	Study of angiosperm with respect to habitat
14.	Field visit to study plant diversity in nature
15.	Project report and photo submission of plant diversity studied in nature

F. Y. B. Sc. Semester I		
BOT-111	Fundamentals of Plant Diversity (Minor-Theory)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Recall different groups of plant kingdom based on characteristic features with examples.	1
CO2	Classify various plant forms based on salient features.	2
CO3	Illustrate the life cycle of different taxonomic forms.	3
CO4	Analyzing economic significance of various groups.	4

Unit No.	Title of Unit and Contents	No. of hours
I	Plant Diversity: 1.1 Introduction 1.2 Importance 1.3 General classification of plant kingdom	2
II	Algae: 2.1 General characters 2.2 Economic importance 2.3 Life cycle of <i>Spirogyra</i> .	5
III	Fungi: 3.1 General characters 3.2 Economic importance 3.3 Life cycle of <i>Rhizopus</i> .	5
IV	Lichens: 4.1 General characters of lichens 4.2 Types of Lichens on the basis of thallus morphology. 4.3 Economic significance.	2
V	Bryophyta: 5.1 General characters 5.2 Economic importance 5.3 Life cycle of <i>Riccia</i> .	4
VI	Pteridophyta: 6.1 General characters 6.2 Economic importance 6.3 Life cycle of <i>Nephrolepis</i> .	5
VII	Gymnosperms: 7.1 General characters 7.2 Economic importance of gymnosperms. 7.3 Life cycle of <i>Cycas</i> .	5
VIII	Angiosperms: 8.1 General characteristics 8.2 Life cycle pattern in angiosperm.	2

References:

1. Jackson, R.B. (2008). *Biology*, 8th edition. San Francisco, California: Pearson Benjamin Cummings.
2. Kumar, H.D. (1999). *Introductory Phycology*, 2nd edition. New Delhi, Delhi: Affiliated East-West Press.
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4. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). *Biology of Plants*. New York, NY: W.H. Freeman and Company
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7. Webster, J., Weber, R. (2007). *Introduction to Fungi*, 3rd edition. Cambridge, U.K.: Cambridge University Press.
8. Sharma, O.P. (1992). *Textbook of Thallophytes*. McGraw Hill Publishing Co. New Delhi.
9. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). *Bryophyta*, S. Chand. Delhi, India.
10. Vashista, B.R. (1978). *Bryophytes*. S Chand & Co. Ltd., New Delhi
11. Parihar, N.S. (1976). *Biology and Morphology of Pteridophytes*. Central Book Depot.
12. Smith, G.M. 1971. *Cryptogamic Botany*. Vol. II. *Bryophytes & Pteridophytes*. Tata Tata McGraw Hill Publishing, New Delhi.
13. Eames, A.J., (1974) *Morphology of vascular plants - Lower groups*. Tata Mc Grew-Hill Publishing Co. New Delhi, Freeman & Co., New York
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16. Vashishta, P.C., Sinha, A.K. and Kumar, A. (2010). *Gymnosperms*, S. Chand and Company Ltd., Ramnagar, New Delhi, India.
17. Pandey, B.P. (2010). *College Botany Vol II*. S. Chand and Company Ltd., New Delhi, India.
18. Sporne, K.R. (1965). *The Morphology of Gymnosperms*. Hutchinson & Co., Ltd., London.
19. Bhatnagar, S.P. and Moitra, A. (1996). *Gymnosperms*. New Age International (P) Ltd Publishers, New Delhi, India.
20. Sharma O.P. (2013). *Plant Taxonomy*. Mc Graw Hill India.
21. Gangulee H.C., Kar, A.K. and Santra S.C. (2011). *College Botany Vol II*. 4th Edition New Central Book Agency.
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2. http://hhh.gavilan.edu/rmorales/documents/Gymnosperm18_withgneto.ppt

F. Y. B. Sc. Semester I		
BOT-112	Botany Practical - 1 (Minor – Practical)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Describe the vegetative and reproductive structure of the forms studied.	1
CO2	Classify the different plant forms to their respective groups based on their thallus structure and reproduction.	2
CO3	Classify the group and differentiate the taxonomic forms.	3
CO4	Identify Life cycle patterns of various groups	4
CO5	Justify the life cycles pattern of different groups with respect to their scientific classification.	5
CO6	Write a tour report and submit photos representing plant diversity.	6

1	Study of vegetative and reproductive structures of <i>Spirogyra</i> .
2	Study of asexual stage and sexual structure of <i>Rhizopus</i> .
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 <i>Riccia</i>
5	Study of vegetative and reproductive structures of <i>Nephrolepis</i>
6	Study of vegetative and reproductive structures of <i>Cycas</i>
7	Study of angiosperms with respect to habit
8	Study of angiosperm with respect to habitat
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-120	Plants in daily life (OE-1)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	State the economic importance of diverse plants that offer resources to humans.	1
CO2	Categorize different habits of plants and their parts in day-to-day life activities.	2
CO3	Classify plants according to their economic value.	3
CO4	Identify the importance of plants and their nutritional value.	4

Unit No.	Title of Unit and Contents	No. of hours
I	Plants: Necessity of Life 1.1 Diverse uses of plants 1.2 Centre of origin	03
II	Study of plants with reference to common name, habit, part used nutritional value and economic importance 2.1 Cereals- Wheat, Rice and Maize 2.2 Millets- Jowar, Bajra, Raagi	03
III	Pulses 3.1 Chickpea 3.2 Pigeon Pea 3.3 Cow pea	03
IV	Sugar 4.1 Sugar cane 4.2 Sugar beet 4.3 Palm Sugar 4.4 Stevia	03
V	Spices 5.1 Clove 5.2 Black pepper 5.3 Cardamom 5.4 Cinnamon	03
VI	Beverages 6.1 Tea 6.2 Coffee 6.3 Cocoa	03
VII	Oils 7.1 Ground nut 7.2 Sunflower 7.3 Mustard 7.4 Coconut	03
VIII	Vegetables 8.1 Carrot	03

	8.2 Potato 8.3 Tomato 8.4 Spinach	
IX	Fruits 9.1 Orange 9.2 Amla 9.3 Mango 9.4 Banana	03
X	Fibers 10.1 Cotton 10.2 Jute 10.3 Coconut	03

References:

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 I		
BOT-121	Plant Propagation (OE-2)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Describe the importance of plants and diversity in their methods of propagation	1
CO2	Understand how different plant materials and environmental conditions affect plant propagation.	2
CO3	Demonstrate proficiency in propagation of plants by seeds and vegetative methods.	3
CO4	Explain the cultivation of different vegetables and flowering plants.	4

Unit No.	Title of Unit and Contents	No. of hours
I	An overview of plants 1.1 Diversity of plants with respect to habit - herb, shrub, tree and climbers 1.2 Diversity of plants with respect to habitat - terrestrial and aquatic 1.3 Plant propagules- root, stem, leaves and seeds	05
II	Seed structure and storage 2.1 Seed: Structure and types, factors affecting germination, seed dormancy; causes and methods of breaking dormancy 2.2 Seed storage: seed production, handling, seed collection, storage and viability testing, seed banks, factors affecting seed viability, seed testing and certification	05
III	Vegetative propagation methods 3.1 Natural propagation- Introduction 3.2 General account of bulbs, corms, tubers, rhizomes, runners, stolons and suckers 3.3 Artificial propagation - Introduction 3.4 Types of propagation: Cuttings – stem leaf and root, selection of cutting, collecting season, treatment, rooting medium and planting of cuttings, Layering- Air layering, Grafting - Stone, Approach, T budding 3.5 Natural and artificial means of vegetative propagation- advantages and limitations	10
IV	Propagation and cultivation of vegetable and flowering plants 4.1 Types of substrates, containers, seeding, pre germination, watering, temperature and light 4.2 Transplanting and handling of seedlings, media and container for transplanting, hardening 4.3 Study of cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's finger, tomatoes, carrots, bougainvillea, roses, geranium, petunia, orchids	10

References:

1. Nanda, K.K. and Kochar V.K. (1985). Vegetative Propagation of Plants. Kalyani Publishers, New Delhi.
2. Ramawat, K.G. et al. (2014). Reproductive Biology of Plants. CRC Press, Boca Raton.
3. Sadhu, M.K. (1999). Plant Propagation. New Age International (P) Limited Publishers, New Delhi

E-resources:

1. <https://www.swayamprabha.gov.in/index.php/program/archive/9>
2. <https://www.youtube.com/watch?v=FCy249PQ8wU>

F. Y. B. Sc. Semester I		
BOT-140	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:		Bloom's cognitive level
CO1	Define fundamentals of digital/ smartphone photography technology.	1
CO2	Describe digital/ smartphone camera functions and their applications.	2
CO3	Employ different photographic equipment to enhance their photographic skills and create digital resources.	3
CO4	Categorize various plant forms and apply the photographic skills in various professions and for entrepreneurship.	4

Unit No.	Title of Unit and Contents	No. of hours
I	Study of camera 1.1 Study the principle and working of digital/smartphone camera.	02
II	Microscope 2.1 Working and handling of light microscopes – Dissecting Microscope 2.2 Working and handling of light microscopes – Compound Microscope	04
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	04
IV	Study of plant morphology through photographs 4.1 Root 4.2 Stem 4.3 Leaf 4.4 Inflorescence 4.5 Flower 4.6 Fruit	08
V	Outdoor/ Campus Photography 5.1 Plants 5.2 Environment 5.3 Landscapes 5.4 Cityscape.	04
VI	Project Work 6.1 Make a portfolio of diverse landscaping patterns/ selected themes through outdoor visits.	08

References:

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 basic photography:the guide for serious photographers. Amsterdam: Focal Press/Elsevier.
6. Peterson, B. (2016). Understanding exposure: how to shoot great photographs with any camera. AmPhoto Books.

E-resources:

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

F. Y. B. Sc. Semester II		
BOT-151	Plant Morphology and Anatomy (Major- Theory)	Credits: 4 Hours: 60
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Define and understand the concepts and fundamentals of plant morphology.	1
CO2	Describe the morphology of plant parts, inflorescence, flower, and fruits.	2
CO3	Interpret the concepts and fundamentals of plant anatomy	3
CO4	Examine the internal primary & secondary anatomy of plant systems and organs.	4

Unit No.	Title of Unit and Contents	No. of hours
I	General organization of plant body 1.1 Root, stem, leaf: Introduction, function and modifications 1.2 Leaf characteristics	03
II	Inflorescence 2.1 Definition and types 2.2 Racemose: raceme, spike, spadix, umbel, and capitulum, 2.3 Cymose: solitary, monochasial, dichasial and polychasial 2.4 Special type: cyathium, hypanthodium	05
III	Flower 3.1 Definition, parts and symmetry 3.2 Insertion of floral whorls on the thalamus: hypogynous, perigynous and epigynous 3.3 Perianth: calyx and corolla. Calyx modifications: petaloid, pappus and spurred 3.4 Corolla forms: cruciform, papilionaceous, infundibuliform, bilabiate 3.5 Androecium: parts of stamen, attachment of anther to filament, length of filaments-didynamous and tetradynamous, position of stamens 3.6 Cohesion of stamens: adelphy, syngeny and synandry Adhesion of stamens: epipetalous, epiphylous and gynandrous 3.7 Gynoecium: parts of a carpel, types: simple, compound (apocarpous and syncarpous) 3.8 Placentation: definition and types	10

IV	Fruit 4.1 Definition, parts of a fruit, classification 4.2 Simple: legume, follicle, capsule, caryopsis, achene, cypsela, drupe, berry (hesperidium) 4.3 Aggregate: etaerio of follicles, achenes and berries 4.4 Multiple: syconus and sorosis	05
V	Plant Anatomy 5.1 Introduction 5.2 Applications in systematics, forensics and pharmacognosy	02
VI	Tissues 6.1 Classification of tissues: Meristematic tissues, Permanent tissues-simple tissues (parenchyma, collenchyma, sclerenchyma) and complex tissues (xylem, phloem) 6.2 Pits and plasmodesmata	05
VII	Stem and leaf 7.1 Organization of shoot apex (Apical cell theory, Histogen theory, Tunica-carpus theory) 7.2 Types of vascular bundles 7.3 Structure of dicot and monocot stem 7.4 Structure of dicot and monocot leaf, Kranz anatomy	08
VIII	Root 8.1 Organization of root apex (Apical cell theory, Histogen theory, Korper- Kappe theory) 8.2 Quiescent center, root cap 8.3 Structure of dicot and monocot root	06
IX	Vascular Cambium 9.1 Structure, function, and seasonal activity of cambium 9.2 Sapwood and heartwood, ring and diffuse-porous wood, early and late wood, tyloses, dendrochronology 9.3 Secondary growth in root and stem 9.4 Anomalies in secondary growth in stem (<i>Bignonia, Dracaena</i>)	08
X	Protective Systems 10.1 Epidermal tissue system: cuticle, epicuticular waxes, trichomes (uni-and multicellular, glandular and non-glandular), stomata	08

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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.
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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.
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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-150	Botany Practical -2 (Major - Practical)	Credits: 2 Hours: 60
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Define and understand concepts and fundamentals of plant morphology and anatomy.	1
CO2	Recognize the morphology of plant parts, inflorescence, flower and fruits.	2
CO3	Sketch the anatomy of dicot and monocot root, stem and leaf.	3
CO4	Examine the protective systems of plants.	4

Any 12 experiments: 10 compulsory + 1 Activity (Equivalent to Two Practical)

Practical No.	Title of the 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 Simple fruit: Fleshy: berry and drupe; Dry: achene, cypsella and legume Aggregate fruit: etaerio of follicles and berries 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 internal primary structure of stem: Monocot and Dicot
9.	Study of internal primary structure of root: Monocot and Dicot
10.	Study of internal primary structure of leaf: Monocot and Dicot
11.	Study of Normal secondary growth in <i>Annona</i> stem (Double stained temporary preparation)
12.	Study of anomalous secondary growth in <i>Bignonia</i> and <i>Dracaena</i> stem (Double stained temporary preparation)
13.	Epidermal tissue system - cuticle, stomata and trichomes
14.	Campus visit for understanding plant morphology
15.	Project report submission on plant morphology studied within the campus

F. Y. B. Sc. Semester II		
BOT- 161	Fundamentals of Plant Morphology and Anatomy (Minor-Theory)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Develop an understanding of the concepts and fundamentals of plant morphology.	1
CO2	Examine the morphology of plant parts, inflorescence, flowers and fruits.	2
CO3	Develop an understanding of the concepts and fundamentals of plant anatomy	3
CO4	Examine the internal anatomy of plant systems and organs.	4

Unit No.	Title of Unit and Contents	No. of hours
I	General organization of plant body 1.1 Root, shoot, leaf: Introduction, functions, modifications. 1.2 Leaf characteristics.	3
II	Inflorescence 2.1 Definition 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	5
III	Flower 3.1 Definition and parts of typical flower: symmetry 3.2 Insertion of floral whorls on the thalamus- Hypogynous, perigynous and epigynous. 3.3 Perianth- Calyx and Corolla. 3.3 Calyx modifications- Petaloid, pappus and spurred, 3.4 Types of Corolla- Cruciform, Papilionaceous, Infundibuliform, Bilabiate. 3.5 Androecium: parts of a typical stamen, arrangement of stamen-tetradynamous, didynamous. 3.6 Attachment of anther- adnate, basifixed, dorsifixed versatile Cohesion - adelphy, syngeny and synandry. Adhesion; epipetalous, epiphyllous and gynandrous. 3.7 Gynoecium: parts of a carpel, types- simple (apocarpous) and compound (syncarpous); Placentation - definition and types.	10
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.	5
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,	4

	sclerenchyma) and complex tissues (Xylem, Phloem). 5.4 Epidermal tissue system; Cuticle, epidermis, trichome (unicellular and multicellular, glandular and non-glandular), structure of typical stomata. 5.5 Vascular tissues; Components of xylem and phloem, types of vascular bundles.	
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.	3

References:

1. Pandey, B.P. 2009. Plant Anatomy. S. Chand and Co., Ltd., New Delhi.
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3. Pandey, B.P. 2011. College Botany, Vol II. S. Chand and CO., Ltd., New Delhi.
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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.
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3. <https://www.youtube.com/watch?v=Q1VosdthSLM>
4. <https://www.youtube.com/watch?v=WfURKyslthI>

F. Y. B. Sc. Semester II		
BOT- 162	Botany Practical -2 (Minor – Practical)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Define and understand concepts and fundamentals of plant morphology and anatomy.	1
CO2	Recognize the morphology of plant parts, inflorescence, flower and fruits.	2
CO3	Sketch the anatomy of dicot and monocot root, stem and leaf.	3
CO4	Examine the protective systems of plants.	4

Any 12 experiments: 10 compulsory + 1 Activity (Equivalent to Two Practical)

Practical No.	Title of the 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 Simple fruit: Fleshy: berry and drupe; Dry: achene, cypsela and legume Aggregate fruit: etaerio of follicles and berries 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 root: Monocot and Dicot
9.	Study of the internal primary structure of stem: Monocot and Dicot
10.	Study of the internal primary structure of leaf: Monocot and Dicot
11.	Epidermal tissue system - cuticle, stomata and trichomes
12.	Campus visit to understand plant morphology
13.	Project report submission on plant morphology studied within the campus

F. Y. B. Sc. Semester II		
BOT -170	Plants in health care (OE-3)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Recall role of medicinal plants in Ayurvedic system of medicine system.	1
CO2	Understand the basic concepts and uses of medicinal plants.	2
CO3	Apply knowledge about commercial aspects of medicinal plants.	3
CO4	Examine various plants for health care.	4

Unit No.	Title of Unit and Contents	No. of hours
I	Herbal medicines 1.1 History and scope 1.2 Role of medicinal plants in Ayurvedic system of medicine 1.3 Cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants	10
II	Plants for hair and skin care 2.1 Plants used for hair care: Reetha, Shikakai 2.2 Plants used for skin care: <i>Aloe vera</i> , Turmeric, Sandal wood	06
III	Plants used for respiratory, nervous and digestive system 3.1 Plants used for respiratory system: Adulsa, Jeshthamadh, Lemon grass, Tulsi, Ginger 3.2 Plants used for nervous system: Brahmi, Ashwagandha 3.3 Plants used for digestive system: Carom, Nutmeg, Bael	08
IV	Plants used for general wellbeing 4.1 Guduchi, Babul, Neem, Jamun 4.2 Amla, Basil, Clove, Lemon.	06

References:

1. Arber, A. (1999). Herbal plants and Drugs. Mangal Deep Publications.
2. Chopra, R.N., Nayar S.L. and Chopra, I.C. (1956). Glossary of Indian Medicinal Plants, C.S.I.R, New Delhi.
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8. Lewis, W. H. and M. P. F. Elwin Lewis. 1976. Medical Botany. Plants Affecting Man's Health. Wiley Inter science Publication. John Wiley and Sons, New York.

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- 171	Plants in human welfare (OE-4)	Credits: 2 Hours: 30
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's cognitive level
CO1	Identify the different types of plants.	1
CO2	Describe the major crops grown around the world and assess their use for human consumption.	2
CO3	Interpret the uses of plants for health.	3
CO4	Differentiate various plants for human welfare.	4

Unit No.	Title of Unit and Contents	No. of hours
I	Introduction 1.1 Role of plants in human welfare	02
II	Study of plants with respect to common name, habit, plantpart 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 2.4 Culinary nuts- Almond, Cashew, Walnut, Pistachio	08
III	Plants in industry 3.1 Paper 3.2 Rubber 3.3 Timber 3.4 Cane	03
IV	Plants as coloring agents 4.1 Heena 4.2 Bixa 4.3 Butea 4.4 Indigo	03
V	Plants as perfume 5.1 Jasmine 5.2 Lavender 5.3 Geranium 5.4 Mint	03

VI	Plants as condiments 6.1 Chilli 6.2 Fennel 6.3 Coriander 6.4 Cumin	03
VII	Plants as biofuel 7.1 Jatropha 7.2 Jojoba 7.3 Castor	03
VIII	Plants as medicine 8.1 Ashwagandha 8.2 Sarpagandha 8.3 Shatawari 8.4 Sadaphuli	05

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1. Textbook of Economic Botany, Verma V., Ane Books Pvt. Ltd.
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3. Economic Botany: Principles and Practices, Gerald E. Wickens, Springer Publication.
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1. https://swayam.gov.in/nd2_ccc19_bt10/preview
2. <https://www.swayamprabha.gov.in/index.php/program/archive/9>