
**Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS),
PUNE**

**Syllabus
for**

S. Y. B. Sc. (Botany)

[Pattern 2019]

(B.Sc. Semester-III and Semester-IV)

From Academic Year

2020-21

Deccan Education Society's
Fergusson College (Autonomous), Pune

S.Y.B.Sc. Subject (Pattern 2019)

From academic year 2020-21

Particulars	Name of Paper	Paper Code	Title of Paper	No. of Credits
S.Y. B.Sc. Semester III	Theory Paper - 1	BOT 2301	Plant Ecology and Taxonomy	2
	Theory Paper - 2	BOT 2302	Plant Physiology and Metabolism	2
	Practical Paper - 3	BOT 2303	Botany Practical	2
S.Y. B.Sc. Semester IV	Theory Paper - 1	BOT 2401	Plant Anatomy and Embryology	2
	Theory Paper - 2	BOT 2402	Economic Botany and Biotechnology	2
	Practical Paper - 3	BOT 2403	Botany Practical	2

S.Y. B.Sc. Semester III**Subject: Botany Paper -1 (BOT2301): PLANT ECOLOGY AND TAXONOMY****[Credits-2]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Recognizes the position of plants in different classification system
CO2 Acquire technique of herbaria preparation
CO3 Classifies and identifies plants upto family level
CO4 Lists out morphological and anatomical adaptive characters in ecological grouping

Unit	Details	Lectures
I	Introduction to Plant Taxonomy 1.1 Concept of Taxonomy and Systematics 1.2 Definition, scope and objectives of taxonomy 1.3 Identification, classification and nomenclature	[2]
II	Identification 2.1 Functions of Herbarium, List of important herbaria and steps in herbarium preparation. 2.2 Botanical gardens of the world and India 2.3 Documentation: flora, virtual herbarium, keys: single access and multi-access 2.4 Taxonomic literature- Flora, Monograph, Revisions Manuals, Journals, Periodicals, References books	[5]
III	Classification 3.1 Types of classification- Artificial-Linnaeus, Natural- Bentham and Hooker and Phylogenetic – Outline of APG system	[5]
IV	Botanical Nomenclature 4.1 Principles and rules (ICN) 4.2 Binomial nomenclature 4.3 Ranks and endings of taxa names 4.4 Typification 4.5 Author citation 4.6 Valid Publication 4.7 Rejection of names 4.8 Principle of priority and its limitations	[6]
V	Study of Plant Families 5.1 Study of following families with reference to geographical distribution, diagnostic characters, floral formula, floral diagram and systematic position 5.2 Polypetalae- Annonaceae, Leguminosae, Myrtaceae, Gamopetalae- Rubiaceae, Apocynaceae, Lamiaceae, Apetalae- Euphorbiaceae and Monocot- Amaryllidaceae	[8]
VI	Ecological grouping of the plants Ecological grouping of the plants with reference to their significance of adaptive external and internal features 6.1 Hydrophytes	[6]

	6.2 Xerophytes	
VII	Phytogeography 7.1 Principle biogeographical zones 7.2 Continental drift- Wagner's Theory 7.3 Endemism	[4]

Books-

1. Chopra G.L.- Angiosperms
2. Datta S.C.- A Hand Book of Systematic Botany
3. Gurucharan Singh -Systematics theory and practice (Oxford IBH)
4. Lawrence, G.H.M -Taxonomy of Vascular Plants. N.Y.Lawrence G.H.M 1955. An Introduction to Plant Taxonomy N.Y.
5. Naik V.N. - Taxonomy of Angiosperms.
6. Pande B.P - Taxonomy of Angiosperms. S.Chand.
7. Priti Shukla and Shital Mishra- An introduction to Taxonomy of angiosperms
8. Santapau H. - The Flora of Khandala on the Western Ghats of India.
9. Singh V. and D.K Jain- Taxonomy of Angiosperms. Rastogi Publication, Meerut.
10. Sharma O.P- Plant taxonomy (Tata Mc grow Hill)
11. Theodore Cooke 1903- The flora of The Presidency of Bombay Vol. I, II, III
12. Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.
13. Michael G. Simpson- Plant systematic.
14. E.P. Odum. 1996 -Fundamentals of Ecology. Natraj Publishing, Dehradun.
15. Kumar.H.D. 1996 - Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.
16. Kumar.H.D. 1997 -General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
17. KermondyF.J. 1996 - Concepts of Ecology. Prentice Hall of India Pvt. Ltd., New Delhi.
18. Weaver. J.E. and Clements. S.E. 1966 -Plant Ecology. Tata McGraw Publishing Co. Ltd. Bombay.

S.Y. B.Sc. Semester III
Botany Paper -2 (BOT 2302): PLANT PHYSIOLOGY AND METABOLISM
[Credits-2]

Course Outcomes

At the end of this course, students will be able to

- CO1** Understand the fundamental physiological process occurring within plants.
CO2 Familiarize with plant water relations.
CO3 Acquire knowledge of mineral nutrition and plant growth regulators.
CO4 Relate to nitrogen metabolism and physiology of flowering.

Unit	Details	Lectures
I	1. Plant – water relations 1.1 Importance of water 1.2 Diffusion – Definition, factors affecting diffusion, importance of diffusion 1.3 Osmosis – Definition, types of solutions – hypotonic, hypertonic and isotonic, endosmosis and exosmosis, concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), Diffusion pressure deficit (DPD), relation between OP, TP and DPD, role of osmosis 1.4 Plasmolysis – Definition, mechanism, deplasmolysis, significance 1.5 Imbibition – Concept, mechanism and significance	[6]
II	2. Transpiration 2.1 Definition; Types of transpiration – cuticular, lenticular and stomatal 2.2 Structure of stomata 2.3 Mechanism of opening and closing of stomata –Steward’s hypothesis, active K ⁺ transport mechanism 2.4 Factors affecting the rate of transpiration 2.5 Significance of transpiration 2.6 Antitranspirants 2.7 Guttation and Exudation	[6]
III	3. Mineral nutrition 3.1 Essential elements- macro and micronutrients, Criteria of essentiality of elements, 3.2. Role and deficiency symptoms of N,P,K	[4]
IV	4. Photosynthesis 4.1 Structure of chloroplast; Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); 4.2 Photosystem I and II, reaction centre. 4.3 Significance of photosynthesis	[3]
V	5. Respiration 5.1 Structure of mitochondria 5.2 Aerobic and Anaerobic respiration 5.3 Significance of respiration	[3]
VI	6. Plant growth regulators 6.1 Discovery and physiological role of auxins, cytokinins, gibberellins, ethylene and abscisic acid	[5]
VII	7. Nitrogen metabolism 7.1 Biological nitrogen fixation – Symbiotic and asymbiotic	[6]

	7.2 Denitrification, ammonification and nitrification 7.3 Reductive amination and transamination	
VIII	8. Plant response to light and temperature 8.1 Photoperiodism – (short day plants, long day plants and day neutral plants) 8.2 Vernalisation – concept and definition, mechanism of vernalisation, applications of vernalisation.	[3]

Books-

1. Devlin R.M. and Witham F. H. (1983). Plant Physiology, Willard Grant Press, U.S.A.
2. Jain V.K. (2000). Fundamentals of Plant Physiology, S. Chand & Co, New Delhi.
3. Pandey S.N. (1991). Plant Physiology, Vikas Publishing House Pvt. Ltd, New Delhi, India.
4. Verma V. (2007). Text Book of Plant Physiology, Ane Books India, New Delhi.
5. Taiz L. and Zeiger E. (2010). Plant Physiology, 5th Edition, Sinauer Associates Inc., U.S.A.
6. Salisbury F.B. and Ross C.W. (1995). Plant Physiology, 3rd Edition, CBS Publishers and Distributors, New Delhi.
7. Hopkins W.G. and Huner N.P. (2009). Introduction to Plant Physiology, 4th Edition, John Wiley & Sons, U.S.A.
8. Noggle G. R and Fritz G. (1983). Introductory Plant Physiology, 2nd Edition, Prentice Hall of India Ltd, New Delhi.
9. Devlin R.M and Witham F.H. (1986). Plant Physiology, CBS Publishers & Distributors, New Delhi.
10. Sundara Rajan S. (2003). Plant Physiology, Anmol Publications Pvt. Ltd, New Delhi.

S.Y. B.Sc. Semester III
Botany Paper -3 (BOT 2303): BOTANY PRACTICAL

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

- CO1** Classifies and identifies plants upto family level
CO2 Lists out morphological and anatomical adaptive characters in ecological grouping
CO3 Able to perform experiments based on plant physiology
CO4 Understand the concept of diffusion, transpiration, plasmolysis

List of practical's (Compulsory 10)**Plant Ecology and Taxonomy**

- | | | |
|---|---|--------------|
| 1 | How to study plant family? (Description of plant in botanical terms). Tools of taxonomy and demonstration of herbarium technique. | [02P] |
| 2 | Study of plant family (any 4) - Leguminosae and Myrtaceae, Apocynaceae and Rubiaceae, Euphorbiaceae and Amaryllidaceae | [02P] |
| 3 | Study of Hydrophytes | [01P] |
| 4 | Study of Xerophytes | [01P] |

Plant Physiology and Metabolism

- | | | |
|---|--|--------------|
| 5 | Determination of Diffusion Pressure Deficit (DPD). | [01P] |
| 6 | Determine rate of transpiration under different conditions of light intensity / Wind velocity. | [01P] |
| 7 | Demonstration Experiments.
a. Imbibition in seeds
b. Osmosis-curling experiment
c. Role of N/ P / K on growth of plants
d. Effect of auxins on rooting
e. Symbiotic nitrogen fixation using root nodules. | [02P] |

Activity (2)

- | | | |
|---|--|--------------|
| 1 | Botanical Excursion | [01P] |
| 2 | Study of plasmolysis in suitable plant material. | [01P] |

S.Y. B.Sc. Semester IV**Subject: Botany Paper -1 (BOT 2401): PLANT ANATOMY AND EMBRYOLOGY****[Credits-2]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Identify monocot and dicot plants based on anatomical peculiarities.
CO2 Acquainted with the normal and anomalous secondary growth in angiosperms.
CO3 Differentiate between different tissues and its function.
CO4 Understand steps involved in sporogenesis in flower.

Unit	Details	Lectures
PLANT ANATOMY		
I	1. Introduction 1.1 Introduction and scope of Plant Anatomy 1.2 Applications in systematics, forensics and pharmacognosy	[2]
II	Meristematic and permanent tissues 2.1 Meristematic Tissues - Apical , Intercalary and Lateral 2.2 Permanent Tissues - Simple Tissues - Parenchyma, Collenchyma and Sclerenchyma, Complex Tissues – Xylem and Phloem.	[4]
III	3 Organs 3.1 Structure of typical dicot and monocot root, stem and leaf.	[4]
IV	4. Normal and Abnormal (anomalous) secondary growth 4.1 Introduction and concept of primary growth and secondary growth. 4.2 Vascular cambium- structure and function, seasonal activity 4.3 Secondary growth in Dicot stem e.g. <i>Annona squamosa</i> 4.4 Abnormal Secondary growth in Dicot stem e.g. <i>Bignonia</i> 4.5 Abnormal secondary growth in Monocot stem e.g. <i>Dracaena</i>	[6]
V	5. Protective system 5.1 Epidermal tissue system- Cuticle, Stomata (Dicot and Monocot) and Epidermis.	[2]
EMBRYOLOGY		
VI	6. Introduction 6.1 Introduction and scope of plant embryology. 6.2 Applications in Taxonomy, Plant Tissue Culture and Plant Breeding.	[2]
VII	7. Sporogenesis in flower 7.1 Structure of anther and pollen 7.2 Microsporogenesis and Microgametogenesis 7.3 Structure and types of ovules 7.4 Megasporogenesis and Megagametogenesis 7.5 Types of embryo sac development - Monosporic, Bisporic and Tetrasporic.	[8]
VIII	8. Pollination and Fertilisation 8.1 Types of Pollination – Contrivances. 8.2 Seed structure appendages and dispersal mechanism (Any 3).	[6]

	8.3 Double fertilisation – Process and significance.	
IX	9. Embryo and Endosperm 9.1 Embryo: Structure of dicot and monocot embryo (Development not expected) 9.2 Endosperm: Types – Nuclear, Cellular and Helobial.	[2]

Books-

1. Chandurkar P J- Plant Anatomy Oxford and IBH publication Co. New Delhi.
2. B P Pandey- Plant Anatomy, S Chand and Co. Ltd, New Delhi.
3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo.
4. Eams and Mc Danie -, An Introduction to Plant Anatomy, McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan.
5. Adriance S Foster - Practical Plant Anatomy, D Van Nostrand Co. INC, New York.
6. Esau - Plant Anatomy, Wiley Toppan Co. California, USA.
7. Pijush Roy - Plant Anatomy, New Central Book Agency Ltd, Kolkata.
8. Pandey S N and Ajanta Chadha - Plant Anatomy and Embryology, Vikas Publishing House, Pvt, Ltd, New Delhi.
9. Bhojwani S S and Bhatnagar S P - An Embryology of Angiosperms.
10. Maheshwari P - An introduction to Embryology of Angiosperm.

S.Y. B.Sc. Semester IV**Botany Paper -2 (BOT 2402): ECONOMIC BOTANY AND BIOTECHNOLOGY****[Credits-2]****Course Outcomes**

At the end of this course, students will be able to

- CO1** Understand the importance of economic botany
CO2 Familiarize with plants as valuable resource to mankind
CO3 Acquaint with basic techniques of biotechnology
CO4 Recognize the importance of biotechnology in crop improvement, remediation of environment and fermentation process

Unit	Details	Lectures
I	Origin of Cultivated Plants 1.1 Concept of centres of origin, their importance with reference to Vavilov's work	[2]
II	Cereals 2.1 Introduction with examples 2.2 Wheat- origin, botanical name, family, part used, morphology and uses of products and by-products	[3]
III	Legumes 3.1 Introduction with examples 3.2 Chickpea- origin, botanical name, family, part used, morphology and uses of products and by-products	[3]
IV	Spices 4.1 Introduction with examples 4.2 Clove- origin, botanical name, family, part used, morphology and uses of products and by-products	[3]
V	Beverages 5.1 Introduction with examples 5.2 Tea- origin, botanical name, family, part used, morphology and uses of products and by-products	[3]
VI	Fibre yielding plants 6.1 Introduction with examples 6.2 Cotton- origin, botanical name, family, part used, morphology and uses of products and by-products	[3]
VII	Modern vegetables Introduction to exotic vegetables and their uses, with respect to broccoli, bell pepper, cherry tomato, red cabbage and lettuce.	[1]
	BIOTECHNOLOGY	
VIII	Introduction 8.1 Biotechnology-Definition, concept and scope 8.2 Interdisciplinary nature of biotechnology	[2]
IX	Plant genetic engineering 9.1 General steps in genetic engineering 9.2 DNA isolation from plants 9.3 Tools used for gene cloning a) Restriction Endonucleases	[8]

	<p>b) Vectors used for gene cloning- Plasmid pUC, Ti plasmid, Binary vector</p> <p>9.4 Insertion of isolated gene into suitable vector (by linkers and homopolymer tail) and ligation.</p> <p>9.5 Selection of recombinant (Blue white screening and Selective markers)</p> <p>9.6 <i>Agrobacterium</i> mediated gene transfer in plants- Co-cultivation</p> <p>9.7 Applications of plant genetic engineering in crop improvement and green genetic engineering</p>	
X	<p>Phytoremediation</p> <p>10.1 Introduction</p> <p>10.2 Phytoremediation- definition and concept</p> <p>10.3 Methods of phytoremediation- rhizofiltration, phytoextraction, phytostabilization, phytovolatilization, phytodegradation</p>	[4]
XI	<p>Fermentation technology</p> <p>11.1 Introduction</p> <p>11.2 Principles of microbial growth</p> <p>11.3 Bioreactors used in fermentations- stirred tank, tubular tower and digestive tank fermenters</p> <p>11.4 Industrial applications of fermentation</p>	[4]

Books-

1. Verma V. (2009). Textbook of Economic Botany, Ane Books Pvt. Ltd.
2. Kochhar S.L. (2009). Economic Botany in the Tropics, 3rd Edition, Macmillan Publishers India Ltd.
3. Wickens G. E. (2004). Economic Botany: Principles and Practices, Kluwer Academic Publishers.
4. Kumar H.D. (2005). Modern Concepts of Biotechnology, Vikas Publishing House Pvt. Ltd, New Delhi, India.
5. Smith J.E. (2009). Biotechnology, 5th Edition, Cambridge University Press.
6. Verma S.K. and Verma M. (2007). A Text Book of Plant Physiology, Biochemistry and Biotechnology, S. Chand and Company Ltd., New Delhi.
7. Chawla H.S. (2009). Introduction to Plant Biotechnology; 3rd Edition, CRC Press.
8. Singh B.D. (2017). Biotechnology, Kalyani Publishers.
9. Dubey R.C. (2014). Text book of Biotechnology, S. Chand and Company Ltd., New Delhi.
10. Satyanarayana U. and Chakrapani U. (2008). Biotechnology, Books & Allied Ltd.

S.Y. B.Sc. Semester IV
Botany Paper -3 (BOT 2403): Botany Practical

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

- CO1** Acquainted with the normal and anomalous secondary growth in angiosperms
CO2 Understand steps involved in sporogenesis in flower
CO3 Identify and study some economically important plants
CO4 Understand basic concepts of biotechnology

List of practical's (Compulsory 10)**Plant Anatomy and Embryology**

- 1 Epidermal tissue system- Dicot and monocot stomata, trichomes **[01P]**
 2 Study of normal secondary growth in *Annona squamosa*.
 (Double stained temporary preparation).
[01P]
 3 Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem
[01P]
 (Double stained temporary preparation).
 4 Study of tetrasporangiate anther – T.S. of mature anther (*Datura*)
[01P]
 5 Study of types of ovules and dicot, monocot embryo.
[01P]

Economic Botany and Biotechnology

- 6 Study of economically important plants
[01P] Cereals- Wheat
 Legumes- Chickpea
 7 Study of economically important plants
[01P] Spices- Clove
 Beverage-Tea
 Fibre- Cotton
 8 Production of citric acid by *Aspergillus niger* and estimation of citric acid by
 titration method.
[01P]
 9 Demonstration of fermentation products.
[01P]
 10 Demonstration of phytoremediation.
[01P]

Activity (2)

- 1 Study of simple and permanent tissue.
[01P]
 2 Study of newly introduced vegetables- Broccoli, Bell peppers,
 Pink cabbage, Lettuce. **[01P]**