
**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		
Title of the Course and Course Code	PLANT ECOLOGY AND TAXONOMY (BOT2301)	Number of Credits : 02
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Outline principle biogeographical zones, Continental drift- Wagner's Theory and Endemism.	
CO2	Explain techniques of herbaria preparation	
CO3	Examine morphological and anatomical adaptive characters in ecological grouping.	
CO4	Classify and identify plants upto family level.	
CO5	Determine the position of plants in different classification system.	
CO6	Revise the biophytogeographical regions and Wagner's theory.	

Unit No.	Title of Unit and Contents	No of Lectures
I	Introduction to Plant Taxonomy Concept of Taxonomy and Systematics, Definition, scope and objectives of taxonomy, Identification, classification and nomenclature	2
II	Identification Functions of Herbarium, List of important herbaria and steps in herbarium preparation, Botanical gardens of the world and India Documentation: flora, virtual herbarium, keys: single access and multi-access, Taxonomic literature- Flora, Monograph, Revisions Manuals, Journals, Periodicals, References books.	5
III	Classification Types of classification- Artificial-Linnaeus, Natural- Bentham and Hooker and Phylogenetic – Outline of APG system	5
IV	Botanical Nomenclature Principles and rules (ICN), Binomial nomenclature Ranks and endings of taxa names, Typification, Author citation, Valid Publication, Rejection of names, Principle of priority and its limitations.	6
V	Study of Plant Families Study of following families with reference to geographical distribution, diagnostic characters, floral formula, floral diagram and systematic position, 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 Hydrophytes, Xerophytes	6

VII	Phytogeography Principle biogeographical zones, Continental drift- Wagner's Theory, Endemism	4
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1. Chopra G.L.- Angiosperms
2. Datta S.C.- A Handbook 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		
Title of the Course and Course Code	Plant Physiology and Metabolism (BOT 2302)	Number of Credits : 02
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Describe the concepts of plant water relations and importance of water.	
CO2	Explain the mechanism and significance of transpiration, distinguish between types of transpiration, guttation and exudation.	
CO3	Classify the nutrients, illustrate their role and deficiency symptoms.	
CO4	Compare the structure of chloroplast and mitochondria, differentiate between types of pigments, photosystems and respiration.	
CO5	Determine the role of different plant growth regulators. Categorize the plants based on photoperiod and explain the concept of vernalization.	
CO6	Write about biological nitrogen fixation and compile the steps involved in nitrogen metabolism.	

Unit No.	Title of Unit and Contents	No of Lectures
I	Plant – water relations Importance of water, Diffusion – Definition, factors affecting diffusion, importance of diffusion, 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, Plasmolysis – Definition, mechanism, deplasmolysis, significance, Imbibition – Concept, mechanism and significance	6
II	Transpiration Definition; Types of transpiration – cuticular, lenticular and stomatal, Structure of stomata, Mechanism of opening and closing of stomata –Steward’s hypothesis, active K ⁺ transport mechanism, Factors affecting the rate of transpiration, Significance of transpiration, Antitranspirants, Guttation and Exudation	6
III	Mineral nutrition Essential elements- macro and micronutrients, Criteria of essentiality of elements, Role and deficiency symptoms of N,P,K	4
IV	Photosynthesis Structure of chloroplast; Photosynthetic Pigments (Chl a, b, xanthophylls, carotene), Photosystem I and II, reaction centre., Significance of photosynthesis	3
V	Respiration Structure of mitochondria, Aerobic and Anaerobic respiration, Significance of respiration	3

VI	Plant growth regulators Discovery and physiological role of auxins, cytokinins, gibberellins, ethylene, and abscisic acid	5
VII	Nitrogen metabolism Biological nitrogen fixation – Symbiotic and a symbiotic, Denitrification, ammonification and nitrification, Reductive amination and transamination	6
VIII	Plant response to light and temperature Photoperiodism – (short day plants, long day plants and day neutral plants), Vernalisation – concept and definition, mechanism of vernalization, applications of vernalisation.	3

References:

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). Textbook 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		
Title of the Course and Course Code	Botany Practical (BOT 2303)	Number of Credits : 02
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Identify the botanical terms used for the description of plant families and the tools of taxonomy.	
CO2	Differentiate plant families based on their morphological characters.	
CO3	Examine the ecological adaptations in hydrophytes and xerophytes based on their external and internal peculiarities.	
CO4	Analyze the phenomena of imbibition and osmosis, articulate the role of mineral nutrients, auxins on plant growth based on demonstration experiments.	
CO5	Measure the rate of transpiration under different conditions of light/wind velocity and interpret the results.	
CO6	Perform experiment to determine diffusion pressure deficit using potato cylinders.	

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

Sr. No.	List of practical	Practical
1	How to study plant family? (Description of plant in botanical terms). Tools of taxonomy and demonstration of herbarium technique.	2P
2	Study of plant family (any 4) - Leguminosae and Myrtaceae, Apocynaceae and Rubiaceae, Euphorbiaceae and Amaryllidaceae	2P
3	Study of Hydrophytes	1P
4	Study of Xerophytes	1P
Plant Physiology and Metabolism		
5	Determination of Diffusion Pressure Deficit (DPD).	1P
6	Determine rate of transpiration under different conditions of light intensity / Wind velocity.	1P
7	Demonstration Experiments. Imbibition in seeds, Osmosis-curling experiment, Role of N/ P / K on growth of plants, Effect of auxins on rooting, Symbiotic nitrogen fixation using root nodules.	2P

Activity (2)

1	Botanical Excursion	1P
2	Study of plasmolysis in suitable plant material.	1P

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	Plant Anatomy and Embryology (Bot 2401)	Number of Credits : 02
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Identify monocot and dicot plants based on anatomical peculiarities.	
CO2	Explain pollination and fertilization in plants.	
CO3	Examine different tissues and its functions.	
CO4	Analyze the steps involved in sporogenesis in flower.	
CO5	Determine embryological stages of the life cycle of higher plants.	
CO6	Specify the differences between the normal and anomalous secondary growth in angiosperms.	

Unit No.	Title of Unit and Contents	No of Lectures
PLANT ANATOMY		
I	Introduction Introduction and scope of Plant Anatomy, Applications in systematics, forensics and pharmacognosy	2
II	Meristematic and permanent tissues Meristematic Tissues - Apical, Intercalary and Lateral, Permanent Tissues - Simple Tissues - Parenchyma, Collenchyma and Sclerenchyma, Complex Tissues – Xylem and Phloem.	4
III	Organs Structure of typical dicot and monocot root, stem and leaf.	4
IV	Normal and Abnormal (anomalous) secondary growth Introduction and concept of primary growth and secondary growth, Vascular cambium- structure and function, seasonal activity, Secondary growth in Dicot stem e.g., <i>Annona squamosa</i> , Abnormal Secondary growth in Dicot stem e.g., <i>Bignonia</i> , Abnormal secondary growth in Monocot stem e.g., <i>Dracaena</i> .	6
V	Protective system Epidermal tissue system- Cuticle, Stomata (Dicot and Monocot) and Epidermis.	2
EMBRYOLOGY		
VI	Introduction Introduction and scope of plant embryology, Applications in Taxonomy, Plant Tissue Culture and Plant Breeding.	2
VII	Sporogenesis in flower	8

	Structure of anther and pollen, Microsporogenesis and Microgametogenesis, Structure and types of ovul Megasporogenesis and Megagametogenesis, Types of embryo sac development - Monosporic, Bisporic and Tetrasporic.	
VIII	Pollination and Fertilisation Types of Pollination – Contrivances, Seed structure appendages and dispersal mechanism (Any 3), Double fertilisation – Process and significance.	6
IX	Embryo and Endosperm Embryo: Structure of dicot and monocot embryo (Development not expected), Endosperm: Types – Nuclear, Cellular and Helobial.	2

References:

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		
Title of the Course and Course Code	Economic Botany and Biotechnology (BOT 2402)	Number of Credits : 02
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Recall centers of origin and their importance.	
CO2	Explain different types of economically important plants and give examples of cereals, legumes, spices, beverages and fiber yielding plants.	
CO3	Examine and explain the role of wheat, chickpea, clove, tea, cotton with respect to their morphology and uses of products and by-products. Identify the exotic vegetables and their uses.	
CO4	Classify and explain the tools used in gene cloning, discuss Agrobacterium mediated gene transfer in plants and outline the application of plant genetic engineering in crop improvement.	
CO5	Compare the methods used for phytoremediation.	
CO6	Write about the bioreactors used in fermentation and summarize the industrial applications of fermentation.	

Unit No.	Title of Unit and Contents	No of Lectures
I	Origin of Cultivated Plants Concept of centres of origin, their importance with reference to Vavilov's work	2
II	Cereals Introduction with examples, Wheat- origin, botanical name, family, part used, morphology and uses of products and by-products.	3
III	Legumes Introduction with examples, Chickpea- origin, botanical name, family, part used, morphology and uses of products and by-products.	3
IV	Spices Introduction with examples, Clove- origin, botanical name, family, part used, morphology and uses of products and by-products	3
V	Beverages Introduction with examples, Tea- origin, botanical name, family, part used, morphology and uses of products and by-products.	3
VI	Fibre yielding plants Introduction with examples, Cotton- origin, botanical name,	3

	family, part used, morphology and uses of products and by-products	
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 Biotechnology-Definition, concept and scope, Interdisciplinary nature of biotechnology	2
IX	Plant genetic engineering General steps in genetic engineering, DNA isolation from plants, Tools used for gene cloning Restriction Endonucleases, Vectors used for gene cloning- Plasmid pUC, Ti plasmid, Binary vector, Insertion of isolated gene into suitable vector (by linkers and homopolymer tail) and ligation, Selection of recombinant (Blue white screening and Selective markers), <i>Agrobacterium</i> mediated gene transfer in plants- Co-cultivation, Applications of plant genetic engineering in crop improvement and green genetic engineering.	8
X	Phytoremediation Introduction, Phytoremediation- definition and concept, Methods of phytoremediation- rhizofiltration, phytoextraction, phytostabilization, phytovolatilization, phytodegradation	4
XI	Fermentation technology Introduction, Principles of microbial growth, Bioreactors used in fermentations- stirred tank, tubular tower and digestive tank fermenters, Industrial applications of fermentation.	4

References:

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 Textbook 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). Textbook 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		
Title of the Course and Course Code	Botany Practical (BOT 2403)	Number of Credits: 02
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Identify the epidermal tissue system.	
CO2	Differentiate between the types of ovules, tetrasporangiate anther, dicot and monocot embryo.	
CO3	Carry out the estimation of citric acid by titration method and determine the amount produced in the fermented broth.	
CO4	Identify economically important plants based on their products.	
CO5	Review the importance of fermentation products and plants used for phytoremediation.	
CO6	Prepare double stained temporary preparation of transverse section of stem of <i>Annona</i> , <i>Bignonia</i> and <i>Dracaena</i> and specify the type of secondary growth.	

List of practical's (Compulsory 10)

Plant Anatomy and Embryology		
Sr. No.	List of practicals (Compulsory 10)	Practical
1	Epidermal tissue system- Dicot and monocot stomata, trichomes	1P
2	Study of normal secondary growth in <i>Annona squamosa</i> . (Double stained temporary preparation).	1P
3	Study of anomalous secondary growth in <i>Bignonia</i> and <i>Dracaena</i> stem, (Double stained temporary preparation).	1P
4	Study of tetrasporangiate anther – T.S. of mature anther (<i>Datura</i>)	1P
5	Study of types of ovules and dicot, monocot embryo.	1P
Economic Botany and Biotechnology		
6	Study of economically important plants, Cereals- Wheat, Legumes- Chickpea	1P
7	Study of economically important plants Spices- Clove, Beverage-Tea, Fibre- Cotton	1P
8	Production of citric acid by <i>Aspergillus niger</i> and estimation of citric acid by titration method.	1P
9	Demonstration of fermentation products.	1P
10	Demonstration of phytoremediation.	1P

Activity (2)

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