

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

**SYLLABUS UNDER AUTONOMY**

**SECOND YEAR B.Sc.  
SEMESTER - III**

**SYLLABUS FOR S.Y. B.Sc. BOTANY**

**Academic Year 2017-2018**

**Deccan Education Society's  
Fergusson College (Autonomous), Pune  
Faculty of Science  
S.Y. B.Sc. (Botany) Syllabus**

<b>Semester</b>	<b>Course Code</b>	<b>Title of the Course</b>	<b>Core / Elective</b>	<b>No. of Credits</b>
III	BOT2301	Theory - 1: Plant Taxonomy and Ecology	Core	3
	BOT2302	Theory - 2: Plant Physiology	Core	3
	BOT2303	Practical 3: Practical based on Paper I Plant Taxonomy and Ecology and Paper 2 Plant Physiology	Core	2
IV	BOT2401	Theory - 1: Plant Anatomy, Embryology and Palynology	Core	3
	BOT2402	Theory - 2: Plant Biotechnology	Core	3
	BOT2403	Practical 3: Practical based on Paper I Plant Anatomy, Embryology and Palynology and Paper 2 Plant Biotechnology	Core	2

PAPER CODE: BOT2301 PAPER - I: <b>PLANT TAXONOMY AND ECOLOGY</b> [Credits - 3: No. of Lectures - 48]		
	<b>Title and Contents</b>	<b>No. of Lectures</b>
Unit - I	<b>Introduction to Plant Taxonomy</b> 1.1 Concept of Taxonomy and Systematic 1.2 Definition, scope and objectives 1.3 Identification, classification, nomenclature	3
Unit - II	<b>Systems of classification</b> 2.1 Types of systems with their merits and limitations- a) Artificial system- Carl Linnaeus b) Natural system -Bentham and Hooker c) Phylogenetic system- Engler and Prantl d. Molecular system of classification- APG	6
Unit - III	<b>Taxonomic literature</b> 3.1 Flora 3.2 Monograph 3.3 Revisions 3.4 Manuals 3.5 Journals 3.6 Periodicals 3.7 References books.	2
Unit - IV	<b>Sources of data for Systematic</b> 4.1 Morphology 4.2 Anatomy 4.3 Cytology 4.4 Embryology 4.5 Phytochemistry 4.6 Molecular biology	5
Unit - V	<b>Botanical Nomenclature</b> 5.1 History 5.2 Binomial nomenclature 5.3 ICBN- principles 5.4 Rules of nomenclature 5.5 Coining of generic names and specific epithets. 5.6 Ranks and endings of taxa names 5.7 Principle of priority 5.8 Effective and valid publications 5.9 Single and double authority citation 5.10 Nomina conservanda	6
Unit - VI	<b>Study of Plant Families</b> Study of following families with reference to systematic position, diagnostic characters, floral formula and floral diagram– Annonaceae, Meliaceae, Myrtaceae, Rubiaceae, Apocynaceae, Solanaceae, , Euphorbiaceae and Amaryllidaceae	8
Unit - VII	<b>Biometrics, numerical taxonomy and cladistics</b>	6

	Characters; Variations; character weighting and coordination; Cluster analysis; Phenograms, Cladograms (definitions and differences)	
Unit - VIII	<b>Introduction to ecology</b> 8.1 Definition 8.2 Concept 8.3 Autecology and Synecology 8.4 Ecosystem and its components: biotic and abiotic. 8.5 Food chain 8.6 Food web 8.7 Ecological pyramids : Pyramid of number, biomass and energy	5
Unit - IX	<b>Ecological grouping of the plants</b> Ecological grouping of the plants with reference to their significance of adaptive external and internal features: Hydrophytes and Xerophytes	3
Unit - X	<b>Community dynamics(Ecological Succession):</b> 10.1 Introduction 10.2 Causes - physiographic, climatic and biotic. 10.3 Succession - a) Principles b) Types - primary and secondary c) Succession on land, rock and in water 10.4 Stages - Nudation, Migration. Competition, Ecesis and Climax.	4

**References:**

1. Chopra G.L.- Angiosperms
2. Cronquist, A. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.
3. Datta S.C.- A Hand Book of Systematic Botany
4. Davis P.H and V.H Heywood .Principles of Angiosperm Taxonomy. Oliver and Boyd , London.
5. Gurucharan Singh -Systematics theory and practice (Oxford IBH)
6. Heywood V.H 1967. Plant Taxonomy, London.
7. Lawrence, G.H.M -Taxonomy of Vascular Plants. N.Y.Lawrence G.H.M 1955. An Introduction to Plant Taxonomy N.Y.
9. Naik V.N. - Taxonomy of Angiosperms.
10. Pande B.P - Taxonomy of Angiosperms. S.Chand.
11. Priti Shukla and Shital Mishra- An introduction to Taxonomy of angiosperms
12. Rendle A.B. - The Classification of flowering plants. 2 Vols. London.
13. Santapau H. - The Flora of Khandala on the Western Ghats of India.
14. Singh V. and D.K Jain- Taxonomy of Angiosperms. Rastogi Publication, Meerut.
15. Sharma O.P, Plant taxonomy (Tata Mc grow Hill)
16. Stewart W.N. and Rathwell G.W. - Paleobotany and the Evolution of plants.
17. Swingle D.B. - A Text book of Systematic Botany. Mc Graw Hill Book Co. New York.
18. Takhtajan A. - Flowering Plants; Origin and Disposal.
19. Theodore Cooke(1903)- The flora of The Presidency of Bombay Vol. I, II, III
20. V.V.Shivrajan-Introduction to Principles plant taxonomy
21. Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.
22. Michael G. Simpson- Plant systematic.

PAPER CODE: BOT2302  
**PAPER - II: PLANT PHYSIOLOGY and METABOLISM**  
 [Credits - 3: No. of Lectures - 48]

	<b>Title and Contents</b>	<b>No. of Lectures</b>
Unit - I	<b>1. Plant – water relations</b> 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
Unit - II	<b>2. Transpiration</b> 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 <sup>+</sup> transport mechanism 2.4 Factors affecting the rate of transpiration 2.5 Significance of transpiration 2.6 Antitranspirants 2.7 Guttation and Exudation	5
Unit - III	<b>3. Mineral nutrition</b> 3.1 Essential elements, macro and micronutrients, Criteria of essentiality of elements, Hydroponics-concept and applications 3.2. Role and deficiency symptoms of N,P,K 3.3 Liquid fertilizers foliar nutrition, fertigation	6
Unit - IV	<b>4. Photosynthesis</b> 4.1 Structure of chloroplast; Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); 4.2 Photosystem I and II, reaction centre, Cyclic and Non-cyclic photophosphorylation, Calvin cycle. 4.3 Concept of photorespiration, Significance of photosynthesis	7
Unit - V	<b>5. Respiration</b> 5.1 Structure of mitochondria 5.2 Aerobic and Anaerobic respiration 5.3 Glycolysis, TCA cycle, Electron transport system and Balance sheet of ATP generation 5.4 Significance of respiration	6
Unit - VI	<b>6. Plant growth and plant growth regulators</b> 6.1 Introduction 6.2 Phases of growth 6.3 Measurement of growth- Arc auxanometer,	6

	6.4 Factors affecting growth 6.5 Plant Growth Regulators- Introduction and definition 6.6 Properties and practical applications of auxins, cytokinins, gibberellins, ethylene and abscisic acid	
Unit - VII	<b>7. Nitrogen metabolism</b> 7.1 Introduction 7.2 Biological nitrogen fixation 7.3 Non-symbiotic nitrogen fixation 7.4 Denitrification, ammonification and nitrification 7.5 Reductive amination and transamination	6
Unit - VIII	<b>8. Physiology of flowering</b> 8.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants, phytochrome and flowering 8.2 Applications of photoperiodism 8.3 Vernalisation – concept and definition, mechanism of vernalisation, applications of vernalisation, devernialization	6
<b>References:</b>		
<ol style="list-style-type: none"> <li>1. Devlin, R.M. And F.H. Witham. (1983). Plant Physiology. Willard Grant Press. U.S.A.</li> <li>2. Moore, T.C. (1979). Biochemistry and Physiology Of Plant Hormones. Springer-Verlag. Berlin.</li> <li>3. Jain, V.K. (2000). Fundamentals Of Plant Physiology, S.Chand&amp;Co, New Delhi.</li> <li>4. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.</li> <li>5. Verma, V. (2007). Text Book of Plant Physiology, Ane Books India, New Delhi.</li> <li>6. Nobel, P.S. (2009). Physicochemical and Environmental Plant Physiology.4th edition Academic Press, UK</li> <li>7. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.</li> <li>8. Salisbury F.B. and Ross C.B. (2005). Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.</li> <li>9. Helgi Opik, Stephen A. Rolfe, Arthur J. Willis. (2005). The Physiology of Flowering Plants, Cambridge University Press, UK</li> <li>10. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley &amp; Sons, U.S.A. 4th Edition.</li> </ol>		

PAPER CODE: BOT2303 <b>PAPER - III: BOTANY PRACTICAL</b> [Credits - 2: No. of Practical's - 10]	
<b>Plant Taxonomy and Ecology</b>	
How to study plant family? (Description of plant in botanical terms)	(01 P)
Study of plant families (any four and at least one from monocot)	(02 P)
Study of ecological adaptations. A) Hydrophytes B) Xerophytes	(02 P)
<b>Plant Physiology and Metabolism</b>	
Determination of Diffusion Pressure Deficit (DPD).	(01 P)
Determine rate of transpiration under different conditions of Sunlight, Shade and Wind.	(01 P)
Study of plasmolysis in suitable plant material	(01 P)
Demonstration Experiments. a. Imbibition in seeds b. Deficiency symptoms c. Hill Reaction d. Ringing Experiment e. Arc Auxanometer f. Effect of auxins on rooting	(02 P)

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SEMESTER - IV**

**SYLLABUS FOR S.Y. B.Sc. BOTANY**

**Academic Year 2017-2018**



PAPER CODE: BOT2401		
PAPER - I: <b>Plant Anatomy , Embryology and Palynology</b>		
[Credits - 3: No. of Lectures - 48]		
	<b>Title and Contents</b>	<b>No. of Lectures</b>
	<b>PLANT ANATOMY</b>	
Unit -I	1.1 Introduction and scope of Plant Anatomy 1.2 Applications in systematics, forensics and pharmacognosy	4
Unit -II	Structure and Development of Plant Body 1.1 Internal organization of plant body 1.2 Types of cells and tissues 1.3 The three tissue systems	6
Unit –III	Normal secondary growth 3.1 Introduction and concept 3.2 Process in stem of <i>Annona squamosa</i> with respect to extrastelar and intrastelar secondary growth 3.3 Annual rings 3.4 Periderm and bark 3.5 Tylosis 3.6 Lenticel	5
Unit –IV	Anomalous secondary growth 4.1 Introduction and causes 4.2 Anomalous secondary growth in <i>Bignonia</i> stem <i>Raphanus sativus</i> root <i>Dracaena</i> stem	5
	<b>PLANT EMBRYOLOGY</b>	
Unit –V	5.1 Introduction 5.2 Definition and scope of plant embryology	1
Unit –VI	Microsporangium and male gametophyte 6.1 Introduction 6.2 Structure of tetrasporangiate anther 6.3 Types of tapetum 6.4 Sporogenous tissue 6.5 Microsporogenesis: process and its types 6.6 Types of microspore tetrad 6.7 Male gametophyte: structure and development of male gametophyte.	5
Unit –VII	Megasporangium and female gametophyte: 7.1 Megasporangium: structure 7.2 Types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous 7.3 Megasporogenesis: tenuinucellate and crassinucellate ovules 7.4 Types of megaspore tetrads.	7

	7.5 Female gametophyte: structure of typical embryo sac 7.6 Types of embryo sacs with examples monosporic, bisporic and tetrasporic	
Unit –VIII	Fertilization: 8.1 Entry of pollen tube 8.2 Discharge of pollen tube content 8.3 Double fertilization (syngamy and triple fusion) 8.4 Significance of Double fertilization	5
Unit- IX	Endosperm and embryo 9.1 Endosperm: Types – nuclear, cellular and helobial. 9.2 Embryo: Structure of dicot and monocot embryo (Development not expected)	2
	<b>PALYNOLOGY</b>	
Unit- X	Palynology 10.1 Definition, applications and importance 10.2 Pollen structure - Polarity, symmetry, size and shape, apertures, exine stratification. 10.3 NPC system. Principles and general outline	8
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Plant Anatomy, Chandurkar P J, Plant Anatomy Oxford and IBH publication Co. New Delhi .</li> <li>2. B P Pandey, Plant Anatomy, S Chand and Co. Ltd, New Delhi</li> <li>3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo,</li> <li>4. Eams and Mc Daniel, An Introduction to Plant Anatomy, McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan</li> <li>5. Adriance S Foster Practical Plant Anatomy, D Van Nostrand Co. INC, Newyork</li> <li>6. Esau, Plant Anatomy, Wiley Toppan Co. California, USA</li> <li>7. Pijush Roy, Plant Anatomy, New Central Book Agency Ltd, Kolkata</li> <li>8. Pandey S N and Ajanta Chadha, Plant Anatomy and Embryology, Vikas Publishing House, Pvt, Ltd, New Delhi</li> <li>9. Bhojwani S S and Bhatnagar S P, An Embryology of Angiosperms</li> <li>10. Maheshwari P, An introduction to Embryology of Angiosperm</li> <li>11. Nair P K K Essentials of Palynology.</li> </ol>		

PAPER CODE: BOT2402 PAPER - II: <b>PLANT BIOTECHNOLOGY</b> [Credits - 3: No. of Lectures - 48]		
	<b>Title and Contents</b>	<b>No. of Lectures</b>
Unit - I	<b>1. Introduction</b> 1.1 Biotechnology- Definition, concept and scope 1.2 Interdisciplinary nature of biotechnology	2
Unit - II	<b>2. Basics of plant genetic engineering</b> 2.1 Introduction and structure of DNA, Central Dogma 2.2 Structure of gene in prokaryotes and eukaryotes- Promoter, coding region and terminator 2.3 General method of DNA isolation from the plants, Agarose Gel electrophoresis 2.4 Tools used for Gene Cloning 2.4.1 Restriction endonucleases 2.4.2 Vector used for gene cloning - Plasmid - pBR322, pUC, Ti Plasmid, Binary vector and Phage- Lambda 2.5 Generation of DNA fragments and ligation 2.6 Selection of Recombinants 2.7 Polymerase chain reaction	14
Unit - III	<b>3. Methods of gene transfer in plants</b> 3.1 Direct gene transfer methods- Electroporation, Biolistic gene transfer 3.2 Vector mediated gene transfer- Agrobacterium mediated gene transfer in plants 3.3 Method of transfer of vector (Co-cultivation) 3.4 Advantages	7
Unit - IV	<b>4. Plant Tissue Culture</b> 4.1 Micropropagation, Case study of Banana 4.2 Haploid Production (Androgenesis) 4.3 Protoplast Culture and Somatic hybridization 4.4 Applications	7
Unit - V	<b>5. Plant Cell Culture</b> 5.1 Introduction- Callus culture and Suspension culture 5.2 Types of suspension culture- Batch Culture and Continuous Culture 5.3 Growth Measurements 5.4 Secondary Metabolite Production 5.5 Immobilized cell system 5.6 Applications	6
Unit - VI	<b>6. Phytoremediation</b> 6.1 Introduction 6.2 Phytoremediation- definition and concept 6.3 Methods of phytoremediation- Rhizofiltration, phytoextraction, phytostabilization,	6

	phytovolatization, phytodegradation.	
Unit - VII	<b>7. Single cell protein</b> 7.1 Introduction 7.2 Need of proteins in diet 7.3 Production of SCP from algae ( <i>Spirulina</i> ) and fungi (Yeast) 7.4 The economic implications of SCP 7.5 Acceptability of SCP	4
Unit - VIII	<b>8. Nano-biotechnology</b> 8.1 Definition and concept 8.2 Applications of nanotechnology in agriculture (fertilizers and pesticides).	2

**REFERENCES:**

1. A text book of biotechnology; 2<sup>nd</sup> Ed; H.D.Kumar ;2005
2. Introduction to Biotechnology; Smith J.N.;2003
3. A.T.B of Plant Physiology, Biochemistry and Biotechnology; Verma S.K. and Verma Mohit 2007; S. Chand Publications.
4. Fundamental Molecular Biology ; Allison LA; 2007
5. Introduction to Plant Biotechnology;2<sup>nd</sup> Ed; Chawla H.S.;2005
6. Techniques for Engineering Genes ; Curell BR et al;2004
7. Techniques for Molecular Biology ; Tagu D & Moussard C; INRA; 2006
8. Gene Cloning and DNA Analysis ; 5th Ed ; Brown TA ; 2006
9. Biotechnology; B.D.Singh; Kalyani Publishers; 2010
10. Recombinant DNA and Biotechnology ; 2nd Ed ; Kreuzer H and Massey A ;ASM;2006
11. Text book of biotechnology, R.C.Dubey, 2009, S.Chand, Delhi
12. Plant Tissue Culture: Theory and Practice. Bhojwani S. S. and Razdan, M. K., 1996, Elsevier Science Amsterdam. The Netherlands.
13. Nanoscale Technology in Biological Systems; R.S. Greco, F.B.Prinz and R.L.Smith 2005 CRC press,

PAPER CODE: BOT2403 PAPER - III: <b>BOTANY PRACTICAL</b> [Credits -2: No. of Practical's - 10]	
<b>Plant Anatomy, Embryology and Palynology</b>	
1	Study of normal secondary growth in <i>Annona squamosa</i> . (01 P) (Double stained temporary preparation).
2	Study of anomalous secondary growth in <i>Bignonia</i> and <i>Dracaena</i> stem (01 P) (Double stained temporary preparation).
3	Study of tetrasporangiate anther – T.S. of young and mature anther. (01 P)
4	A) Study of types of ovules. (01 P) B) Study of dicot and monocot embryo.
5	Observation of Exine ornamentation (any two) (01 P)
<b>Plant Biotechnology</b>	
6	Production of citric acid by <i>Aspergillus niger</i> and estimation of citric acid by titration method. (01 P)
7	Production of single cell protein production i.e. <i>Spirulina</i> / yeast and study of commercial products. (01 P)
8	Demonstration of bioreactor and fermentation products. (01 P)
9	Demonstration of separation of plant DNA by agarose gel electrophoresis. (01 P)
10	Demonstration of enzyme immobilization (01 P)