

**MANGALORE UNIVERSITY**

**BOTANY**

**(CORE AND GROUP-II ELECTIVE COURSES)**

**SYLLABUS**

**FOR**

**B.Sc. UNDER GRADUATE (UG) PROGRAMME**

**UNDER CBCS SCHEME**

**With effect from**

**Academic Year**

**2018-19**

**COURSES AND CREDITS**  
**B.Sc. with Botany as an Optional Subject**

	Semester-wise Course Topics	Teaching hrs/ week	Exam duration (Hrs)	Marks			No. of Credits
				I.A	Exam	Total	
<b>SEMESTER - I</b>							
Group I	BSCBOC 131 Microbes and Algae (T)	4	3	20	80	100	02
	BSCBOP 132 Microbes and Algae(P)	3	3	10	40	50	01
Group II	BSCBOCE 133 Elective Course:	2	2	10	40	50	01
<b>SEMESTER - II</b>							
Group I	BSCBOC 181 Fungi, Bryophytes, Histology and Anatomy(T)	4	3	20	80	100	02
	BSCBOP 182 Fungi, Bryophytes, Histology and Anatomy (P)	3	3	10	40	50	01
Group II	BSCBOCE 183 Elective Course:	2	2	10	40	50	01
<b>SEMESTER - III</b>							
Group I	BSCBOC 231 Pteridophytes, Gymnosperms and Angiosperm embryology(T)	4	3	20	80	100	02
	BSCBOP 232 Pteridophytes, Gymnosperms and Angiosperm embryology(P)	3	3	10	40	50	01
Group II	BSCBOCE 233 Elective Course:	2	2	10	40	50	01
<b>SEMESTER - IV</b>							
Group I	BSCBOC 281 Taxonomy and Economic Botany (T)	4	3	20	80	100	02
	BSCBOP 282 Taxonomy and Economic Botany (P)	3	3	10	40	50	01
Group II	BSCBOOE 283 Open Elective Course:	2	2	10	40	50	01
<b>SEMESTER - V</b>							
Group I	BSCBOC 331 Ecology and Environmental Biology (T1)	3	3	20	80	100	02
	BSCBOC 332 Plant Physiology (T2)	3	3	20	80	100	02
	BSCBOP 333 Ecology and Environmental Biology (P1)	2	2	10	40	50	01
	BSCBOP 334 Plant Physiology (P2)	2	2	10	40	50	01
<b>SEMESTER - VI</b>							
Group I	BSCBOC 381 Cytology, Molecular Biology and Genetics(T1)	3	3	20	80	100	02
	BSCBOC 382 Plant Propagation and Plant Biotechnology (T2)	3	3	20	80	100	02
	BSCBOP 383 Cytology, Molecular Biology and Genetics (P1)	4	4	10	40	50	01
	BSCBOP 384 Plant Propagation and Biotechnology (P2)	4	4	10	40	50	01
	T= Theory, P=Practicals					<b>Total Credits</b>	<b>28</b>

## **List of Elective Courses:**

**BSCBOCE 133: Mushroom Cultivation Technology**

**BSCBOCE 183: Herbal Technology**

**BSCBOCE 233: Vegetative and Reproductive Morphology of Angiosperms**

**BSCBOOE 283: Plant Diversity for Human Welfare**

### **Note:**

1. IA marks to be awarded based on 02 tests or 01 test and seminars/home assignments/ any other activities in theory and one practical test, in practicals.
2. Field study/ Industrial Tours / Visit to Research Institutes to be undertaken wherever necessary and specified to provide experiential learning opportunities and first hand exposure to students

**SEMESTER – I**

**BSCBOC 131: Microbes and Algae -Theory**

Unit	Topics	Teaching Hours
I	<p><b>Introduction to Botany:</b> Introduction to Botany, main branches and scope. Contributions of Indian Botanists – Sir J. C. Bose, BirbalSahni, P. Maheshwari, B.G.L. Swamy, E. K. Janaki Ammal and M. S. Swaminathan. Whittaker’s Five kingdom system of classification of organisms with examples.</p> <p><b>Viruses, Viroids and Prions:</b> Discovery of viruses, General characters of viruses -living and non-living features, Classification based on hosts and nature of genetic material. Ultra structure and multiplication of TMV. Symptoms and control measures of banana bunchy top disease, tobacco mosaic disease and yellow mosaic of beans. Viroids – structure, symptoms and control of Potato spindle tuber disease. A brief account of Prions.</p> <p><b>Phytoplasma:</b> Structure, symptoms and control of little leaf of brinjal and sandal spike disease.</p>	12
II	<p><b>Bacteria:</b> Types based on cellular morphology, flagellation and mode of nutrition. Ultra structure of Bacterial cell. Reproduction: binary fission and endospore formation. Genetic recombination in bacteria - conjugation, transformation and transduction (generalized type). Economic importance of bacteria- Useful and harmful aspects. Symptoms and control measures crown gall and citrus canker diseases.</p> <p><b>Algae:</b> Occurrence with examples: aquatic, terrestrial and extreme habitats. Thallus organization with examples: unicellular- <i>Chlorella</i>, <i>Chlamydomonas</i>, colonial- <i>Volvox</i>, filamentous- <i>Oedogonium</i>, <i>Cladophora</i>, pseudo parenchymatous-<i>Polysiphonia</i>, siphonaceous - <i>Vaucheria</i>, parenchymatous - <i>Ulva</i>. General methods of reproduction with examples: vegetative –fission, fragmentation, hormogones and tubers. Asexual - exospore, endospore, nannospore, akinetes, zoospores, aplanospores, hyphospores and tetraspores. Sexual – isogamy, anisogamy and oogamy.</p>	12
III	<p><b>Algae – contd.:</b> Types of life cycles in algae (only schematic representations) with an example to each type: haplontic, diplontic, isomorphic, heteromorphic and triphasic. Fritsch’s classification of algae up to the level of classes with examples. Pigmentation in different classes of algae.</p> <p><b>Myxophyceae (Blue green algae):</b></p>	12

	Ultra structure of cyanobacterial cell and heterocyst. Thallus structure of <i>Gloeocapsa</i> , <i>Nostoc</i> , <i>Oscillatoria</i> and <i>Scytonema</i> . <b>Chlorophyceae:</b> Classification, thallus structure and reproduction of <i>Chara</i> .	
IV	<b>Xanthophyceae:</b> Classification, thallus structure and reproduction of <i>Vaucheria</i> <b>Bacillariophyceae:</b> Types of diatoms with examples: pennales and centrales. Classification, thallus structure and reproduction of a pennales diatom ( <i>Pinnularia/Navicula</i> ). <b>Phaeophyceae:</b> Classification, thallus structure and reproduction of <i>Sargassum</i> . <b>Rhodophyceae:</b> Classification, thallus structure and reproduction of <i>Polysiphonia</i> . <b>Economic importance of algae:</b> Useful aspects- food, SCP, industrial products, medicine, sewage treatment, bio-fertilisers, pollution indicators and energy source. Harmful aspects- algal blooms, algal toxins and parasitic algae.	12

#### REFERENCE BOOKS:

1. SURESH NARAYAN and PULLAIAH, 2010, **EMINENT INDIAN BOTANISTS – PAST AND PRESENT**, REGENCY PUBLICATIONS, NEW DELHI.
2. DUBEY, R. C., and MAHESHWARI, D. K., 2009, **A TEXT BOOK OF MICROBIOLOGY**, S CHAND PUBLISHERS.
3. SINGH, PANDE and JAIN, 2015, **A TEXT BOOK OF BOTANY**, RASOGI PUBLICATIONS
4. DEY S. N. and P. S. TRIVEDI. 1977. **A TEXT BOOK OF BOTANY VOL I** VIKAS.
5. GANGULEE, DAS and DATTA 2002, **COLLEGE BOTANY VOL II** NCBA (P) LTD
6. SUNDARA RAJAN S., 2009, **COLLEGE BOTANY VOLUME 1**, HIMALAYA PUBLICATIONS
7. KUMAR H. D. and H.N. SINGH. 1996. **A TEXT BOOK OF ALGAE**, EAST WEST PRESS. NEW DELHI.
8. PELCZAR M. J., E.C.S CHAN and N. R. KRIEG. 2008. **MICROBIOLOGY 5<sup>TH</sup> EDITION**. MC GRAW HILL.
9. PUROHIT S. S 1989, **VIRUSES, BACTERIA and MYCOPLASMAS**, AGROBOTANICAL PUBL.
10. SMITH G. M. 1955. **CRYPTOGAMIC BOTANY VOL I. ALGAE and FUNGI**. MCGRAW HILL BOOK CO. INC. 2<sup>ND</sup> EDITION.
11. SMITH K. M 1990. **PLANT VIRUSES 6<sup>TH</sup> EDITION** UNIVERSAL BOOK STALL NEW DELHI.
12. VASHISTHA B.R., SINHA A. K. and SINGH V.P. 2004. **BOTANY FOR DEGREE STUDENTS, ALGAE**

**SEMESTER – I**  
**BSCBOP 132: Microbes and Algae –Practicals**

<b>Practical No.</b>	<b>Experiment</b>
1	Microscopy technique: Study of Light compound and Dissecting microscopes – Parts, working Principle, handling and preparation of temporary mountings
2	Study of TMV and Phytoplasma with the help of electron micrographs. Study of viral and phytoplasma diseases mentioned in theory with the help of specimens/photographs.
3	Microscopic observation of Bacterial cells by simple staining (Positive-Crystal violet, Negative- Nigrosine or Indian Ink)
4	Differential staining of Bacteria - Gram's staining. Study of Bacterial diseases mentioned in theory with the help of specimens/photographs.
5	Study of thallus structure of <i>Nostoc</i> , <i>Oscillatoria</i> and <i>Scytonema</i>
6	Study of thallus structure of <i>Volvox</i> and <i>Oedogonium</i>
7	Study of thallus and reproductive structures of <i>Chara</i>
8	Study of thallus and reproductive structures of <i>Vaucheria</i> and <i>Diatoms</i>
9	Study of thallus and reproductive structures of <i>Sargassum</i>
10	Study of thallus and reproductive structures of <i>Polysiphonia</i>

**SEMESTER – II**

**BSCBOC 181: Fungi, Bryophytes, Histology and Anatomy -Theory**

Unit	Topics	Teaching Hours
I	<p><b>Fungi:</b> Salient features, mycelial organization- prosenchyma, pseudo parenchyma, rhizomorph and sclerotium. General methods of reproduction with examples: vegetative -fragmentation, fission and budding. Asexual – zoospores, chlamydo spores, oidia and aplanospores. Sexual – planogametic copulation, gametangial contact, gametangial copulation, spermatization and somatogamy. Alexopoulos system of classification up to the level of classes with examples. Classification, thallus structure and reproduction of <i>Phytophthora</i>, <i>Rhizopus</i>, <i>Penicillium</i>, and <i>Puccinia</i>.</p>	12
II	<p><b>Plant-Fungal Interactions and Economic importance of Fungi:</b> Fungal diseases in plants-causative organism, symptoms and management of Koleroga of arecanut, Stem bleeding of Coconut, Blast disease of Rice, Leaf rust of Coffee and Wilt of Pepper. Lichens: Classification- asco and basidiolichens. Morphological types with examples- crustose, foliose and fruticose. Internal structure of thallus – homeomerous and heteromerous types. Structure of fruiting bodies - soredium, cephalodium, isidium, apothecium and perithecium, Economic importance. Mycorrhizae: definition, types – ecto and endomycorrhizae, significance to plants and fungi. Economic importance of Fungi: Useful aspects – food value, industrial products, medicinal products, bio control agents. Harmful aspects- pathogens, food spoilage, toxins, poisonous fungi.</p>	12
III	<p><b>Bryophytes:</b> Salient features, Rothmaler’s classification to the level of classes with examples. Classification, thallus morphology, anatomy and reproduction of <i>Riccia</i>, <i>Porella</i>, <i>Anthoceros</i> and <i>Funaria</i>. Evolution of sporophytes in bryophytes – theory of progressive sterilization and simplification.</p>	12
IV	<p><b>Plant Histology and Anatomy:</b> Introduction to tissues, general classification of tissues. Meristematic tissues: definition, classification based on origin, function and position. Theory of shoot organization – tunica corpus theory, Theory of root organization - histogen theory. Permanent Tissues: simple permanent tissues - structure, types and functions of parenchyma, sclerenchyma and collenchyma. Complex permanent tissues - structure, composition and functions of xylem and phloem. Secretory tissues: Glandular trichomes, nectars, glands, laticifers and resin ducts. Primary anatomy of dicot and monocot root, stem and leaf. Normal secondary growth in dicot stem and root.</p>	12

## REFERENCE BOOKS:

1. ESAU. K. (1980) : PLANT ANATOMY, (2ND EDITION) WILEY EASTERN LTD., NEW DELHI, BANGALORE, BOMBAY, CALCUTTA, MADRAS, HYDRABAD
2. FAHN, A. (1997) : PLANT ANATOMY PERGAMON PRESS, OXFORD-
3. GANGULEE, DAS and DUTTA 2002, COLLEGE BOTANY VOL IINCBA(P) LTD.
4. PANDEY S.N, S.P MISRA and P.S RIVEDI 1972. A TEXT BOOK OF BOTANY VOL II. 2/3 VIKAS PUBL.
5. SRIVASTAVA H.N., PANDEY S.N. S.P MISRA and P. S TRIVEDI 1972. A TEXT BOOK OF BOTANY VOL II. 2<sup>ND</sup> EDITION VIKAS PUBLICATIONS.
6. SRIVASTAVA H.N 1998. BRYOPHYTA. S CHAND PUBLICATIONS
7. VASHISTA P.C 1994, PLANT ANATOMY, PRADEEP PUBLICATIONS ,NEW DELHI
8. SINGH, PANDE and JAIN, 2015, A TEXT BOOK OF BOTANY, RASTOGI PUBLICATIONS
9. TAYAL, M.S., 2012, PLANT ANATOMY, RASTOGI PUBLICATIONS
10. SINGH, PANDE and JAIN, 2015, STRUCTURE, DEVELOPMENT AND REPRODUCTION IN ANGIOSPERMS, RASTOGI PUBLICATIONS
11. SUNDARA RAJAN S.,2011, COLLEGE BOTANY VOLUME 2, HIMALAYA PUBLICATIONS
12. ALEXOPOULOS C.J. 1962. INTRODUCTORY MYCOLOGY WILEY EASTERN LTD.,
13. DUBE H.C 1983, AN INTRODUCTION TO FUNGI, VIKAS PUBLICATIONS.
14. BENDRE A. M. AND A. KUMAR, 2014. PRACTICAL BOTANY VOLUME – 1, RASTOGI PUBLICATIONS
15. SHARMA, P.D., 2017. PLANT PATHOLOGY RASTOGI PUBLICATIONS.



## SEMESTER – II

### BSCBOP 182: Fungi, Bryophytes, Histology and Anatomy - Practicals

Practical No.	Experiment
1	Study of <i>Phytophthora</i> and <i>Rhizopus</i>
2	Study of <i>Penicillium</i> and <i>Puccinia</i>
3	Study of fungal diseases : koleroga of Arecanut, Blast disease of Rice, Stem bleeding of Coconut, Rust of Coffee , wilt of pepper (specimens or photographs)
4	Study of Lichens- morphological types, internal structure and reproductive structures using specimens and permanent slides
5	Study of structure and reproduction of <i>Riccia</i> and <i>Porella</i>
6	Study of structure and reproduction of <i>Anthoceros</i> and <i>Funaria</i>
7	Study of permanent tissues – types of parenchyma, sclerenchyma, collenchyma, xylem and phloem using permanent slides/sections/macerations
8	Study of Primary anatomy of dicot and monocot stem with the help of hand cut stained sections
9	Study of Primary anatomy of dicot and monocot root with the help of hand cut stained sections
10	Study of anatomy of dicot stem/root by double staining procedure

## SEMESTER – III

### BSCBOC 231: Pteridophytes, Gymnosperms and Angiosperm Embryology – Theory

Unit	Topics	Teaching Hours
I	<p><b>Pteridophytes:</b> Salient features, Smith’s system of classification up to the level of classes with examples. <i>Psilotum</i>:Morphology of sporophyte and gametophyte, anatomy of stem and synangium. <i>Lycopodium</i>:Morphology of sporophytes of both sub-genera Urostachya and Rhopalostachya. Stem anatomy of <i>L. cernuum</i>, <i>L. clavatum</i> and <i>L. phlegmaria</i>. Morphology and anatomy of strobilus of <i>L. cernuum</i>, selago-condition. Structure of different types of gametophytes. <i>Selaginella</i>:Morphology of sporophyte, anatomy of stem, rhizophore and strobilus.Heterospory and its significance. <i>Equisetum</i>:Morphology of sporophyte, anatomy of intermodal part of stem. Structure of cone- L.S. of cone, sporangiophore and spore.</p>	12
II	<p><b>Pteridophytes (contd.) and Palaeobotany:</b> <i>Ophioglossum</i>: Morphology of sporophyte, Structure of spike- L.S and T.S.. <i>Osmunda</i>: Morphology of sporophyte,Structure of tassel – T.S. <i>Pteris/Pteridium</i>:Morphology of sporophyte, anatomy of stem and sporophyll, structure of gametophyte. <i>Marsilea</i>:Morphology of sporophyte, anatomy of stem, structure of sporocarp – H.L.S. <b>Palaeobotany:</b> Introduction,Geological time scale, Types of plant fossils – compressions, impressions, incrustations, petrifications and actual remains with examples. Fossil Pteridophytes: <i>Rhynia</i> – Morphology of sporophyte, anatomy of stem, structure of sporangium. <i>Lepidodendron</i> – Morphology of sporophyte, anatomy of stem.</p>	12
III	<p><b>Gymnosperms:</b> Salient features,Sporne’s system of classification up to the level of classes with examples. Fossil Gymnosperm: <i>Lyginopteris</i>- T.S. of stem <i>Cycas</i>: Indian species, morphology of male and female sporophytes, morphology and anatomy of coralloid root, anatomy of leaflet and young stem, secondary growth and anatomy of old stem. Reproduction – vegetative and sexual*. <i>Pinus</i>:Indian species, morphology of sporophyte, morphology and anatomy of needle. Sexual reproduction*. <i>Gnetum</i>: Indian species, morphology of sporophyte, anatomy of young stem,</p>	12

	secondary growth and anatomy of old stem. Sexual reproduction*. Economic importance of Gymnosperms. (*Study of developmental aspects related to the process of reproduction are not included).	
IV	<b>Angiosperm embryology:</b> Morphology and anatomy of mature anther, microsporogenesis, structure and development of male gametophyte, structure of mature pollen grain. Types of ovule, structure of orthotropous ovule, placentation, megasporogenesis- tenuinucellate and crassinucellate types, development of monosporic female gametophyte – <i>Polygonum</i> type. Structure of 7-celled female gametophyte. Pollination: Definition, self and cross pollination and their types, contrivances for self and cross pollination, types of pollination based on agents, modification of plants/flowers for hydrophily, anemophily, entomophily and zoophily. Fertilization: Steps, process and significance of double fertilization. Endosperm: Structure and development of cellular, free nuclear and helobial endosperms, functions of endosperm. Structure of dicot and monocot embryos and seeds.	12

#### REFERENCE BOOKS:

1. Bhojwani S.S, Bhatnagar S.P and Dantu, P. K. 2015. The Embryology of Angiosperms, 6<sup>th</sup> Ed. Vikas Publishing House New Delhi.
2. Charles B. Beck, 2011. An Introduction to Plant Structure and Development. Cambridge University Press
3. B.P. Pandey, 2008. Botany for Degree students. S. Chand Publications
4. Shukla A.K, 1999. Biology of Pollen. Atlas Books and Periodicals.
5. B.P. Pandey, 2000: Simplified course in Botany. S. Chand Publications
6. Sundara Rajan, S, 2011. College Botany Vol. 3. Himalaya Publishing House.
7. Kumaresan and A. Reginald, 2013. Pteridophytes, Gymnosperms and Paleobotany, Saras Publications.
8. P. C. Vashishta, 2013. Text Book of Gymnosperms. S. Chand Publishers
9. Johri B. M. 2015. Embryology of Angiosperms. Springer Publications.
10. Sambamurthy, AVSS., 2005. Text Book of Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany. JK International Publishers.

## SEMESTER – III

### BSCBOP 232: Pteridophytes, Gymnosperms and Angiosperm embryology - Practicals

Practical No.	Experiment
1	Study of <i>Psilotum</i> (morphology of sporophyte, T.S of stem, T.S. of synangium) and <i>Lycopodium</i> ( morphology of sporophyte, stem anatomy, L.S. of strobilus).
2	Study of <i>Selaginella</i> (morphology of sporophyte, T. S. of stem, T,S. of rhizophore, L.S. of strobilus) and <i>Equisetum</i> (external morphology, anatomy of stem, L.S. and T.S. of strobilus).
3	Study of <i>Ophioglossum</i> (morphology of sporophyte, L.S. and T.S. of spike) and <i>Osmunda</i> (morphology of sporophyte, TS. of tassel)
4	Study of <i>Pteris/Pteridium</i> (morphology of sporophyte, T.S. of rhizome, T.S. of sporophyll) and <i>Marselia</i> (morphology of sporophyte, T.S. of rhizome, H.L.S. of sporocarp)
5	Study of <i>Cycas</i> (external morphology of sporophyte, coralloid root anatomy, leaflet anatomy, male cone, microsporophyll, megasporophyll and V.S. of ovule)
6	Study of <i>Pinus</i> (external morphology of sporophyte, needle anatomy, male and female cones, pollen grains)
7	Study of <i>Gnetum</i> (external morphology of sporophyte, male and female cones, V.S. of ovule)
8	Study of types of plant fossils, and examples of Pteridophyte and Gymnosperm fossils included in the syllabus, with the help of slides / photographs.
9	Study of T.S. of anther, morphology of pollen grains, types of ovules and placentation – with the help of permanent slides or temporary mountings
10	Study of monocot and dicot embryos by temporary mountings and permanent slides, Study of pollination mechanisms.

## SEMESTER – IV

### BSCBOC 281: Taxonomy and Economic Botany -Theory

Unit	Topics	Teaching Hours
I	<p><b>Fundamentals of Plant Taxonomy:</b> Introduction to Taxonomy, systems of classification: artificial - Carlous Linnaeus, natural- Bentham and Hooker, phylogenetic - Engler and Prantl, their merits and demerits. Brief introduction to cyto-taxonomy, chemo-taxonomy, numerical taxonomy and molecular taxonomy, DNA barcoding of plants. A brief study of APG system of plant classification with focus to latest APG IV system. Botanical nomenclature: Binomial nomenclature, a brief introduction to ICBN – principles and rules, ranks of taxa and taxonomic types. Herbaria and herbarium techniques, digital herbaria. Botanical Survey of India, Botanical gardens and their functions.</p>	12
II	<p><b>Plant families -1:</b> Distinguishing features, local examples and economic importance of the following families of angiosperms, according to Bentham and Hooker system: <b>Polypetalae-</b> Annonaceae, Malvaceae, Fabaceae and its sub-families, Rutaceae, Anacardeaceae, Myrtaceae, Cucurbitaceae and Apiaceae.</p>	12
III	<p><b>Plant families-II:</b> Distinguishing features, local examples and economic importance of the following families of angiosperms, according to Bentham and Hooker system: <b>Gamopetalae-</b> Rubiaceae, Asteraceae, Apocynaceae, Solanaceae and Lamiaceae. <b>Monochlamydeae</b> – Amaranthaceae and Euphorbiaceae. <b>Monocotyledonae-</b> Orchidaceae, Arecaceae and Poaceae.</p>	12
IV	<p><b>Economic Botany:</b> Introduction to economic botany. Cereals: Significance as food, classification-major and minor cereals with examples. Botany*, products and uses of Rice and Wheat. Pulses: Significance as food. Botany and uses of Mung bean and Pigeon pea Spices and condiments: Definition. Botany and uses of Asafoetida, Cinnamon, Clove, Black pepper, Cardamom and Nutmeg. Beverages: Definition. Botany, processing and uses of Tea, Coffee and Cocoa. Oil yielding plants: Types of plant oils with examples -fatty oils and essential oils. Botany, extraction/processing and uses of Coconut, Groundnut, Rose and Sandalwood oils. Fiber yielding plants: Types of plant fibers – bastfibers, surface fibers and leaf fibers. Botany, processing and uses of Cotton and Jute fibers. Timber yielding plants: General properties of wood, important timber yielding plants of India and their uses. Rubber yielding plants: Botanical source, extraction/processing and uses of Hevea rubber.</p>	12

	<p>Medicinal plants: Botany and uses of <i>Rauwolfia serpentina</i>, <i>Centella asiatica</i>, <i>Gymnema sylvestre</i>, <i>Tinospora cordifolia</i> and <i>Aloevera</i>  A general account of outdoor and indoor ornamental plants.  A general account of ethnobotany: definition, branches and significance.</p> <p>Note: *<b>Botany includes botanical name, family, place of origin and parts used.</b></p>	
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#### REFERENCE BOOKS:

1. S.K .Jain1995. Manual of Ethnobotany. Scientific publishers.
2. Dutta, S.C 1988. Systemic Botany, Wiley Eastern, New Delhi.
3. Sing. G 1999. Plant Systematics;Theory and Practical. Oxford and IBH, New Delhi
4. S. Sundar Rajan-2007. College Botany Vol-V, Part 1:Taxonomy and Economic Botany Himalaya Publishing House.
5. Susil Kumar Mukharjee-2004. College Botany Vol-III. New Central Book agency, London
6. A.V.S.S Sambamurthy2009. Taxonomy of Angiosperm. I.K International Pvt. Ltd. New Delhi
7. B.K. Verma 2011. Taxonomy of Angiosperms. PHI Learning Pvt.Ltd. New Delhi.
8. Saxena and Saxena 2014. Plant Taxonomy, PragatiPrakashan Meerut.
9. B P Pandey-2014. Modern Practical Botany Vol II. S. Chand Publication
10. P.Vasanth Kumar2014. Economic Botany. Sonali Publications New Delhi.
11. A.K Sharma 2015. Taxonomy of Angiosperms and Utilization of Plants. PragatiPrakashan Meerut.
12. O.P Sharma2016. Plant Taxonomy. Mc.Graw Hill Education. Pvt. Ltd. New Delhi.
13. K. GopalakrishnaBhat 2014. Flora of South Kanara, Published by the author.
14. Singh V. and Jain D. K. 2016. Taxonomy of Angiosperms. Rastogi Publications.

## SEMESTER – IV

### BSCBOP 282: Taxonomy and Economic Botany -Practicals

Practical No.	Experiment
1	Study of Annonaceae and Malvaceae
2	Study of Fabaceae sub- families
3	Study of families Rutaceae andAnacardeaceae
4	Study of Myrtaceae, Cucurbitaceae and Apiaceae
5	Study of families Rubiaceae andAsteraceae
6	Study of families Apocynaceae, Solanaceae and Lamiaceae
7	Study of families Amaranthaceae andEuphorbiaceae
8	Study of families Orchidaceae, Arecaceae and Poaceae
9	Study of economically important plants and collection/observation of economic botany products listed in theory syllabus- cereals, pulses, spices/condiments, timbers, beverages and medicinal plants
10	Study of different types of plant fibers and oils. Study of tapping/processing of rubber with the help of charts.

#### **Activities:**

1. Field visits to study the botanical name, family, common names and economic/ethno botanical importance of local angiosperms found in flowering. A brief report of such field visits with the list of plants observed and field photographs/diagrams should be included in the practical record.
2. Visits to local plantations or extraction/processing units of economically important plants/products listed in the syllabus to study the cultivation practices, harvesting procedures, extraction/processing steps, product diversity, etc. A report should be produced at the time of practical examination

## SEMESTER V

### BSCBOC 331: Ecology and Environmental Biology -Theory

Unit	Topics	Teaching Hours
I	<p><b>Ecological factors and adaptations:</b>            Climatic factors: Influence of light, temperature, precipitation, humidity and wind on vegetation.            Edaphic factors: Soil and its types, soil texture, soil profile, soil formation, physico-chemical properties of soil -mineral particle, soil pH, soil aeration, organic matters, soil humus and soil microorganisms.            Ecological adaptations: Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.</p>	09
II	<p><b>Ecosystems:</b>            Introduction, types of ecosystem with examples -terrestrial and aquatic, natural and artificial.            Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.            Ecosystem functions and processes: Food chain-grazing and detritus, Food web, Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem.            Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle- Phosphorus.            Ecological succession: Definition, types- primary and secondary. Hydrosere and xerosere.</p>	09
III	<p><b>Phytogeography and environmental issues::</b>            Phyto-geographical regions of India, Vegetation types of India with special reference to Karnataka- composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shola forests and grasslands.            Causes, consequences and control of Airpollution, Water pollution and Soil pollution.            Causes, consequences and control of Green house effect and ozone depletion.            Global climatic changes and its consequences.</p>	09
IV	<p><b>Natural resources and their management:</b>            Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity.            Concept of endemism in plants, endemic plants of Western Ghats            Concept of Biodiversity Hotspots, Biodiversity hot spots of India.            Concept of Rare, Endangered and Threatened plants (RET plants), RET plants of Western Ghats.            Soil resources—soil erosion and its prevention, maintenance of soil fertility.            Water resources- problem of water scarcity, rain water harvesting, watershed management.            Forest resources: Ecological and economical importance of forests. Deforestation-causes and effects. <i>In-situ</i> and <i>ex-situ</i> conservation of forests and wildlife –reserve</p>	09



	forests, sacred groves, national parks, sanctuaries, biosphere reserves, seed banks, gene banks and botanical gardens.	
<b>Total</b>		<b>36 Hours</b>

### REFERENCE BOOKS:

1. Daubenmire, R.F. (2012 ): Plants & Environment (2nd Edn.,) John Wiley & Sons., New York
2. Puri, .G.S. (1960): Indian Forest Ecology (Vol.I& II), Oxford Book Co., New Delhi & Calcutta.
3. Billings, W.B. (1965): Plants and the Ecosystem, Wadsworth Publishing Co., Inc., Belmont.
5. Odum E.P. (1971): Fundamentals of Ecology (2nd Edn.,) Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Sharma, P.D. (2017): Ecology and Environment, 17<sup>th</sup> Ed. Rastogi Publications.
7. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
8. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
9. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
10. Kumar H.D. (2000): Biodiversity & Sustainable Conservation, Oxford & IBH Publishing Co Ltd. New Delhi.
11. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
12. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
13. Edward J. Kormondy (2017): Concepts of Ecology, Pearsons Publishers.
14. Singh K.K. (2008): Natural Resources Conservation and Management. M D. Publications
15. Singh, M.P. (2005): Environment and Natural Resources. Satish Serial Publishing House.

## SEMESTER –V

### BSCBOC 332: Plant Physiology - Theory

Unit	Topics	Teaching Hours
I	<p><b>Plant – Water relations:</b>                      Fundamental concepts: Diffusion, Imbibition, Osmosis- endosmosis, exosmosis and osmotic pressure. Plasmolysis and Deplasmolysis. Water potential and its components,. Water absorption by plants: Soil water and its types, Mechanism of water absorption- Passive and Active absorption. Path of water movement- symplast, apoplast and transmembrane movement of water.                      Ascent of sap: Definition, path of ascent of sap, mechanism- root pressure theory and transpiration pull theory.                      Transpiration: Types – cuticular, lenticular and stomatal. Structure of stomata, mechanism of stomatal transpiration – starch hydrolysis and proton pump theories. Factors influencing transpiration. Significance of transpiration. Anti-transpirants and their practical applications. A brief account of Guttation.</p>	09
II	<p><b>Mineral Nutrition and Enzymes:</b>                      Essential elements: Classification - Macro and Micronutrients. Functions and deficiency symptoms of macro elements- N, P, K and Mg. Functions and deficiency symptoms of Micronutrients- Zn, Mn and B. Hydroponics and its applications.                      Mechanism of mineral salt absorption: Passive absorption – diffusion, ion exchange. Active absorption- Cytochrome pump theory, Protein Lecithin theory.                      Enzymes: General properties of enzymes, IEC system of enzyme classification and nomenclature, mechanism of enzyme action, models of enzyme action - lock and key and induced fit models, enzyme inhibition- competitive and non-competitive, factors regulating enzyme action.</p>	09
III	<p><b>Photosynthesis, Organic translocation and Respiration:</b>                      Photosynthesis: Photosynthetic reaction, photosynthetic pigments, photosystems I and II. Mechanism of photosynthesis - Light reaction and Dark reaction. Absorption spectrum and Action spectrum. Red drop and Emerson's effect. C<sub>4</sub> pathway and its significance. Factors affecting photosynthesis and law of limiting factors,                      Translocation of organic solutes: Path of translocation - Girdling experiment and isotopic studies. Mechanism of translocation- Protoplasmic streaming theory and Mass flow theory.                      Respiration: Definition and overall reaction, types of respiration- aerobic, anaerobic/ fermentation. Mechanism of aerobic respiration – glycolysis, Krebs's cycle and terminal oxidation. Anaerobic respiration – alcoholic and lactic acid fermentation. ATP yield during aerobic and anaerobic respirations. Respiratory quotient.</p>	09
IV	<p><b>Plant growth, Flowering, Movements and Dormancy:</b>                      Plant growth: Definition, Phases of growth, Growth curve.                      Plant growth regulators: Growth promoters – Physiological effects of auxins, gibberellins and cytokinins. Growth inhibitors – Physiological effects of ethylene and abscisic acid. Practical applications of growth regulators in the field of agriculture and horticulture</p>	09

	<p>Physiology of flowering: Photoperiodism - short day, long day and dayneutral plants. Phytochrome theory. Vernalisation and its practical applications.</p> <p>Plant movements: Nastic movements – nyctinastic, chemonastic and seismonastic. Tropic movements – phototropic, hydrotropic, geotropic and thigmotropic.</p> <p>Dormancy in plants: Definition and types. Bud dormancy - induction and breaking. Seed dormancy – causes and methods of breaking.</p>	
<b>Total</b>		<b>42 Hours</b>

### REFERENCE BOOKS:

1. Mukherjee, S. A.K. Ghosh(1998) Plant Physiology ,Tata McGraw Hill Publishers(P) Ltd., New Delhi.
2. Salisbury, F.B & C.W. Ross (1999): Plant Physiology CBS Publishers and Printers, New Delhi.
3. Pandey, SN and Sinha, BK (2001). Plant Physiology. Third revised edition, Vikas Publishing House Pvt. Ltd, New Delhi
4. Devlin, RM (1974). Plant Physiology, Affiliated East West Press Pvt. Ltd
5. Noggle, GR. and Fritz, GJ (1976). Introductory Plant Physiology, Prentice-Hall, India.
6. Jain, VK (2007). Fundamentals of Plant physiology, S. Chand & Company ltd, New Delhi.
7. Nobel, PS (1970). Introduction to Biophysical Plant Physiology. W. H. Freeman and Company, San Francisco.
8. Verma, V(2008). Text book of plant Physiology, Ane's student edition, New Delhi
9. SundaraRajan S (2012). College Botany, Vol. VI. Part 2- Plant Physiology. Himalaya Publications.
10. Jain V.K. (2017). Fundamentals of Plant Physiology. S Chand Publishers.

**SEMESTER –V**  
**BSCBOP 333: Ecology and Environmental Biology – Practicals**

Practical No.	Experiment
1	Determination of pH of different types of Soils
2	Estimation of salinity of soil/water samples.
3	Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
4	Hydrophytes: Morphological adaptations in <i>Pistia</i> , <i>Eichhornia</i> , <i>Hydrilla</i> , <i>Nymphaea</i> and Anatomical adaptations of Hydrophytes - <i>Hydrilla</i> and <i>Nymphaea</i> .
5	Xerophytes: Morphological adaptations in <i>Asparagus</i> , <i>Casuarina</i> , <i>Acacia</i> , <i>Aloe vera</i> , <i>Euphorbia tirucalli</i> and Anatomical adaptations of <i>Casuarina phylloclade</i> .
6	Epiphytes: Morphological adaptations in <i>Acampe</i> , <i>Bulbophyllum</i> , <i>Drynaria</i> and Anatomical adaptations of epiphytic root of <i>Acampe/ Vanda</i> . Halophytes: Vivipary and Pneumatophores
7	Study of local vegetation types by field trips
8	Project work
9	Project work
10	Project work

**\*PROJECT WORK ON ECOLOGY:**

Students should undertake a short project related to any of the following ecological aspects, either individually or in groups, and submit the report at the time of practical examination along with the certified class record.

Project Reports to be prepared according to the Format provided.

Projects may be undertaken on:

- Structure of local ecosystems - pond ecosystem /forest ecosystem/grassland ecosystem/river ecosystem/marine ecosystem.
- Documentation/assessment of ecosystem services like carbon sequestration by trees.
- Enumeration/documentation of local biodiversity
- Listing of local RET species of plants, assessment of their population status, etc.
- Documentation of local conservation practices , sacred trees, sacred landscapes, etc.
- Documentation/Assessment of local pollution issues, etc.

**Format for Project Report (Typed or Handwritten):** The project Report must present information organised in the following sections. The number of pages may be limited to 10-15 typed pages in case of individual projects and 20-25 pages, in case of group projects.

1.	Introduction with objectives of the work
2.	Review of literature/ earlier work
3	Study area and Methods followed

4	Results
5	Discussion and Conclusions
6	References

## SEMESTER – V

### BSCBOP 334: Plant Physiology -Practicals

Practical No.	Experiment
	<b>Major Experiments:</b>
1	Experiment to measure the solute potential of the cell sap by plasmolytic method.
2	Demonstration/ Determination of rate of transpiration using Ganongs Potometer
3	Demonstration of transpiration pull/Suction force due to transpiration.
4	Separation of plant pigments by paper chromatography method.
5	Determination of RQ of germinating seeds using Ganongs Respirometer
6	Demonstration of activity of Peroxidase/Catalase enzyme
7	Estimation of sugar/protein by colorimetric method
	<b>Minor Experiments/Demonstrations</b>
1	Potato osmoscope /Thistle funnel experiment to demonstrate osmosis
2	Demonstration of unequal transpiration from leaf surfaces using GarreausPotometer
3	Demonstration of imbibition pressure using germinating seeds
4	Demonstration of O <sub>2</sub> liberation during photosynthesis by bubbling method
5	Measurement of growth using arc auxanometer
6	Demonstration of plant movements – Heliotropism, Geotropism, Hydrotropism
7	Demonstration of transpiration using bell jar
8	Demonstration of fermentation using Kuhn's Fermentation vessel

## SEMESTER –VI

### BSCBOC 381: Cytology, Molecular Biology and Genetics -Theory

Unit	Topics	Teaching Hours
I	<p><b>Cytology:</b> Structure of plant cell, Ultra-structure and functions of cellwall, plasmamembrane-fluid-mosaic model, endoplasmic reticulum, chloroplast, ribosomes, golgi complex, mitochondria, peroxisome and vacuole. Ultrastructure of nucleus - nuclear membrane, nuclear pore complex and nucleolus. Ergastic substances in plant cells.</p> <p><b>Cell Division and Chromosomes:</b> Types of chromosomes based on centromere position, Autosomes and Allosomes, structure of metaphase chromosome, Ultra structure of Chromosomes- Nucleosome model. Cell cycle, Mitosis in plant cells– karyokinesis and cytokinesis, Meiosis in plant cells, mechanism of crossing over, significance of mitosis and meiosis.</p>	09
II	<p><b>Structure, Chemistry and Expression of Gene:</b> Experiments to prove DNA as genetic material – Griffith experiment, Avery. McCarty and MacLeod experiment, Hershey - Chase experiment DNA: Chemical composition, types -A, B and Z DNA, structure-Watson &amp; Crick model, Semiconservative replication. RNA: Structure and functions of m RNA, t RNA and r RNA. Structure of Gene: Cistron, recon and muton concept.Prokaryotic and eukaryotic genes. Genetic code and its properties. Gene Expression: Transcription and Translation in prokaryotes, process of Gene splicing. Regulation of gene expression in prokaryotes- Lac operon model.Gene regulation in eukaryotes- transcriptional and post-transcriptional.</p>	9
III	<p><b>Genetics:</b> Introduction to genetics, Brief biography of Mendel and his experiments on pea plants. Monohybrid cross and law of segregation, dihybrid cross and law of independent assortment. Test cross and back cross-monohybrid and dihybrid. Incomplete dominance- flower color in <i>Mirabilis</i>. Multiple alleles – self sterility in tobacco. Gene Interactions with plant examples: Complimentary -9:7, Supplementary -9:3:4 and Epistasis – Dominant, 12:3:1 ratio. Polygenic inheritance - kernel color in wheat. Linkage and its types – cis and trans, complete and incomplete. linkage in Maize.</p>	09

	Mechanisms of sex determination in Plants – <i>Melandrium</i> , <i>Cocciniaindica</i> , <i>Asparagus</i> and <i>Maize</i> .	
IV	<p><b>Genetic variations and Extra nuclear genome:</b></p> <p>Gene mutations: Spontaneous mutations, Induced mutations - physical and chemical mutations. Molecular basis of mutations- base substitutions and frameshift mutations.</p> <p>Chromosomal Aberrations: Types and cytological consequences of Deletion, Duplication, Inversion and translocation.</p> <p>Variation in chromosome number: Aneuploidy and its types, Euploidy and its types.</p> <p>Polyploidy in plants: Auto and allopolyploids - natural and artificial with examples, significance of polyploidy.</p> <p>Extra nuclear genome-features and functions of plastid and mitochondrial DNA.</p> <p>Transposable genetic elements with Maize as an example.</p>	09
<b>Total</b>		<b>36 Hours</b>

### REFERENCE BOOKS:

1. S SundaraRajan, 2004, Genetics, Anmol Publications Ltd.
2. Gupta P.K 1999. A text book of Cell and Molecular Biology. Rastogi publication Meerut
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
5. Gardner, E.J., Simmons, M.J., Snustad, D.P. 2008. Principles of Genetics. 8th Edition Wiley India.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.. 2012. Introduction to Genetic Analysis. IX Edition W.H. Freeman and Co.
7. Burns G.W. 1983. The Science of Genetics - An Introduction to Heredity. 5th edition Mac Millan Publ.
8. David Freifelder 1996. Essentials of Molecular biology Panima Publishing company New Delhi.
9. Gardner E.J., M.J. Simmons & D.P. Snustad. 1991. Principles to Genetics 8th edition. John Wiley & Sons
10. Gupta P.K. 2000 Genetics and Cytogenetics. Rastogi Publishers.
11. Iug W.S. & M.R. Gummings 2003. Concepts of Genetics 7 edition. Pearson Edition
12. Kumar H.D. 2000. Molecular Biology. Vikas Publishers.
13. Malacinski G.M. & D. Freifelder 1998. Essentials of Molecular Biology. Jones & Bartlett Publ. Boston. 3 edition
14. Powar C.B. 2005, Cell Biology 3 edition Himalaya Publishing New Delhi.
15. Sambamurty A.V.S.S. 1999. Genetics, Narosa Publ House.
16. Sheeler P. & D.E. Bianchi 1987. Cell and Molecular Biology, 3rd edition. John Wiley & Sons.
17. Singh B.D. 2004. Genetics. Kalyani Publ.
18. Strickberger M.W. 2005. Genetics 3rd edition. MacMillan Publ.
19. Vasishta P.C. & P.S. Gill 1998. Cell Biology & Molecular Biology, Pradeep Publications
20. Verma P.S. & V.K. Agarwal 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & company New Delhi.

**SEMESTER –VI**  
**BSCBOC 382: Plant Propagation and Biotechnology-Theory**

Unit	Topics	Teaching Hours
I	<p><b>Plant Propagation and Plant Breeding:</b>            Methods of Plant propagation: Cutting -Root, Stem and Leaf, Grafting-Wedge, Whip, Approachand Crown, Layering- Underground and Air Layering .            History and Objectives of plant breeding.            Methods of Plant breeding: Introduction, Selection- Pure line, Clonal and Mass line.            Polyploidy breeding, Mutation Breeding, Hybridization - types and technique.            Male sterility-Types, production and significance in plant breeding.</p>	09
II	<p><b>Plant Tissue Culture:</b>            History and Scope, concept of cellular totipotency.            Tissue culture laboratory and Equipments            Basic aspects of plant tissue culture- Sterilization, Culture media and its preparation.            Role of growth hormones in plant tissue culture.            Types of cultures-Callus culture and Organogenesis. Pollen culture and haploid plant production. Embryo culture. Somatic embryogenesis and synthetic seeds.Protoplast culture and somatic hybridization techniques.            Application of plant tissue culture in Agriculture, Forestry, Industries and plant conservation</p>	09
III	<p><b>Plant Biotechnology:</b>            Introduction to Plant Genetic Engineering.            Tools used in genetic engineering: Enzymes- Restriction endonucleases, DNA ligase, Vectors - pBR 322, Ti and Ri plasmid vectors, artificial chromosomes, difference between cloning and expression vectors.            General steps of recombinant DNA technology using plasmid vectors and bacterial host cell.            Gene transfer methods to plant cells: Agrobacterium based gene transfer technique, Directgene transfer – microinjection, electroporation, microprojectile techniques. Plant regeneration from transformed cells.            Transgenic plants: Definition and examples, Steps involved in the production of golden rice and Bt cotton. Applications and threats from transgenic plants.</p>	09
IV	<p><b>Environmental Biotechnology:</b>            Introduction and scope of environmental biotechnology.            Biotechnology in air pollution control – biofilters and their applications.            Biotechnology in waste water treatment: Aerobic and anaerobic treatment methods with examples.            Bioremediation and phytoremediation, biocomposting.            Biopesticides- types and applications.Biofertilisers- types and applications.            Biofuels- Production and applications of biogas, bioethanol, biodiesel and algal biofuels.            Biomining and bioleaching – methods and applications.</p>	09



	Biodegradable plastics – plastics from cellulose, chitin, microbes and transgenic plants.	
<b>Total</b>		<b>36 Hours</b>

### REFERENCE BOOKS:

1. Allard R.W(1999): The Principles of Plant Breeding, John & Wiley and Sons.
2. Poelman J.M (2005); Breeding Field Crops, Springer.
3. George Acquaah(2012):Principles of Plant Genetics & Breeding: Wiley-Blackwell.
4. Bose T.K. & Mukherjee, D. (1972): Gardening in India, Oxford & IBH Publishing Co., New Delhi.
5. Sandhu, M.K. (1989) Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
6. Kumar, N. (1997): Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
7. Pullaiah. T. and M.V.SubbaRao. (2009). Plant Tissue culture. Scientific Publishers, New Delhi.
8. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
9. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
10. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
11. Gupta P.K. (2010), Plant Biotechnology, Rastogi Publications, Meerut.
12. Monica Jain (2014), Environmental Biotechnology, Narosa Publishing House, New Delhi.
13. Mohapatra, P. K. (2007), Textbook of Environmental Biotechnology, IK International, New Delhi.

## SEMESTER –VI

### BSCBOP 383: Cytology, Molecular Biology and Genetics -Practicals

Practical No.	Experiment
1	Study of Cell structure from Onion /Rheoleaf peel under light compound microscope
2	Study of ergastic substances - starch (potato), aleurone (wheat grain), calcium oxalate (Pistia), calcium carbonate (Ficusleaf), oil globules (castor seed) and Raphides (Colacasia petiole).
3	Measurement of length and Breadth of cells by micrometry technique (Using Onion or Rheo leaf cells)
4	Study of different stages of mitosis by squash technique using Onion root tip cells
5	Study of different stages of meiosis using Rheo or Onion flower buds
6	Observation of permanent slides of mitosis and meiosis
7	Genetic problems related to laws of Mendel (Minimum 04 problems)
8	Genetic problems related to incomplete dominance and multiple allelism (Minimum 04 problems)
9	Genetic problems related to interaction of genes (Minimum 02 problems each for 9:7 and 9:3:4 ratio)
10	Genetic problems related to interaction of genes (Minimum 02 problems each for 12:1 ratio and Polygenic interaction)

## SEMESTER –VI

### BSCBOP 384: Plant Propagation and Biotechnology – Practicals

Practical No.	Experiment
1	Study of plant propagation methods-Cutting, Layering and Grafting
2	Techniques of emasculation, artificial pollination and bagging
3	Estimation of percentage of pollen viability (In-vitro method) by hanging drop method.
4	Study of tissue culture lab equipments – autoclave, laminar air flow cabinet, hot air oven, incubator
5	Preparation of Synthetic seeds by alginate encapsulation
6	Preparation of tissue culture media (MS), surface sterilization, Inoculation and callus induction.
7	Demonstration of DNA isolation from plant tissues.
8	Demonstration of Electrophoresis.
9	Study of transgenic plant production with the help of charts.
10	Study of designs of waste water treatment plants

#### Field Activities:

1. Visits to waste water treatment plants and composting sites to study the operations involved.
2. Visits to biofertiliser and biopesticide production sites in the locality to study the production methods.
3. Visits to local nurseries and institutions involved in plant breeding to study the various methods and techniques employed.



**Instruction to Examiners:**

A -Any algal specimen,

B and C- Any algal specimen

D and E -pathology materials infected by bacteria or Virus / Phytoplasma (colour photographs may also be used)

F - Bacterial culture/curd sample/ root nodule suspension,

G,H and I- Slides. At least 01 slide should be from Cyanophyta.

**Mangalore University**  
**B.Sc. II semester - Practical Examination**  
**Fungi, Bryophytes, Histology and Anatomy**  
**Question paper and Scheme of evaluation**

Time: 3 hrs. Batch..... Date..... Time.....am/pm Max. Marks: 40

1. Prepare a temporary stained section of the material A. sketch, label and identify with reasons. Leave the preparation for inspection 06
2. Identify B & C giving reasons 3+3= 06
3. Write critical notes on D & E with labelled sketches 3+3= 06
4. Sketch, label and identify with reasons the slides F, G, H & I 3+3+3+3 =12
5. Record and Submission- 2 permanent slides of Anatomy 7+3=10

1	A		Prep. Sk Id Cl Rea 2 1½ ½ ½ 1½ = 6	Reg. No. of Candidates Assigned
2	B C		Id Rea 1 2 = 3 each Sketch and Classification not required	
3	D E		Id* SkCr. Nts. ½ 1 1½ = 3 each  Classification not required	<u>Reg. No. of absentees:</u>  <u>Total examined:</u>
4	F G H I		Sk Id Cl Rea 1 ½ ½ 1  = 3 each	<u>Examiners:</u>  1.Internal
5	a b	Record Permanent slides	07 03  =10	2.External

**Instruction to Examiners:**

A from dicot or monocot stem/root. B and C from Fungi  
 D and E from pathology and Lichens  
 F,G,H and I - one slide each from Fungi and Histology and two slides from Bryophyta

**Mangalore University**  
**B.Sc. III Semester Botany- Practical Examination**  
**Pteridophytes, Gymnosperms and Angiosperm Embryology**  
**Question paper and Scheme of evaluation**

Time: 3 hrs. Batch..... Date..... Time.....am/pm Max. Marks: 40

1. Prepare a temporary stained section of the material A. Sketch, label and identify.  
 Leave the preparation for inspection. 06
2. Sketch, Label, and identify specimens B and C 3+3=6
3. Write critical notes on D, E and F with identification and labelled sketches. 3+3+3=9
4. Sketch, label and identify with reasons the slides G, H, and I. 3+3+3=9
5. Class Record 7+2+1=10

1	A		Prep	03	Reg. No. of Candidates Assigned
			Sk	02	
			ID	01	
				<u>06 each</u>	
2	B		Sk	01	Reg. No. of <u>absentees:</u>
	C		ID	01	
			Reason	<u>01</u>	<u>Total examined:</u>
				03 each	
3	D		Sk	01	
	E		ID	½	
	F		CN	<u>01½</u>	
				03 each	<u>Examiners:</u>  1.Internal
4	G		Sk	1	
	H		Id	½	
	I		Cl	½	
			Rea	1	
				= 3 each	2.External
5		Record		10	

**Instruction to Examiners:**

A from Pteridophyta/ Gymnosperms

B and C - one each from Pteridophytes and Gymnosperms

D, E and F one specimen each from Pteridophyta ,Gymnosperms and fossil forms (slide/Photograph may also be used)

G, H & I- two slides from Pteridophyta and one from Embryology

**Mangalore University**  
**B.Sc. IV Semester- Practical Examination**  
**TAXONOMY & ECONOMIC BOTANY**  
**Question Paper and Scheme of evaluation**

Time: 3 hrs. Batch..... Date..... Time.....am/pm Max. Marks: 40

1. Systematically assign the plants **A, B** and **C** to their respective families, giving diagnostic features. 4X3=12
2. Describe the plant **D** in technical terms. 06
3. Give the floral diagram and floral formula of **E** 03
4. Give the economic importance of **F, G** and **H** mentioning the common name, botanical name, family and parts used. 3+3+3=09
5. a) Class records 07+03=10  
 b) Herbarium with field notes

1	A		Derivation 01 Family Name 01 Characters 02	Reg. No. of Candidates Assigned
	B		04 each	
	C			
2	D		Description 06	<u>Reg. No. of absentees:</u>
3	E		Fl. Dia 02 Fl. Form 01	<u>Total examined:</u>
			03 each	
4	F		Com. Name ½ Bot. Name ½	
	G		Family ½ Parts used ½	
	H		Eco. Imp. 01	
5		a) Records	07	2. Internal
		b) Herbarium with field notes	03	

**Instruction to Examiners:**

A, B and C- one each from Polypetalae, Gamopetalae and Monochlamydeae  
 D from Polypetalae/Gamopetalae  
 E from Polypetalae/Gamopetalae  
 F, G and H from different groups of economically important products



**Mangalore University**  
**B.Sc. V Semester Course-1-Practical Examination**  
**Ecology and Environment**

**Question paper and Scheme of evaluation**

Time: 3 hrs. Batch..... Date..... Time.....am/pm Max. Marks: 40

1. Prepare a stained temporary mount of the T. S of material **A**. Draw a labelled diagram and comment on the ecological features of its anatomy. Leave the slide for inspection. 06
2. Estimate the salinity/Determine the pH of the given sample **B**. Write the procedure and result. 05
3. Write critical notes on **C&D** with labelled sketches. 3+3= 06
4. Describe the use and working mechanism of ecological instrument **E** 03
5. Project work report and viva-voce 15
6. Practical Record 05

1	A		Prep Sk Features	02 02 <u>02</u> 06	Reg. No. of Candidates Assigned
2	B		Procedure Result Inference	02 02 <u>01</u> 05	<u>Reg. No. of absentees:</u>
3	C		Ecol. Group Ecol. features	01 02 <u>          </u> 03	<u>Total examined:</u>
	D				<u>Examiners:</u>
4	E		Identification Working principle	01 <u>02</u> 03	
5		Project report/ Viva -voce		13+02=15	1.External
6		Class Record		05	2.Internal

**Instruction to Examiners:**

A from Hydrophyte/Xerophyte/ Epiphyte/ Halophyte

B any soil or water sample

C and D Specimen from Hydrophyte/Xerophyte/ Epiphyte/ Halophyte

E any ecological apparatus/photo

- Project Viva has to be conducted by both Internal and External Examiners, in consultation with each other and to be restricted to the work conducted by students. Maximum 04 questions only.

**Mangalore University**  
**B.Sc. V Semester Course-2-Practical Examination**  
**Cytology, Genetics and Molecular Biology**  
**Question paper and Scheme of evaluation**

Time: 3 hrs. Batch..... Date..... Time.....am/pm Max. Marks: 40

1. Prepare a squash of **A** for the study of mitosis. Leave the slide for Inspection.07
2. Determine the length and breadth of the given material **B** by micrometric method. 04
3. Solve the genetic problem **C** and **D** 4+4= 08
4. Identify the cytological stages in the slides **E** and **F** with labelled diagram 4+4= 08
5. Identify the ergastic substance in the given permanent or temporary preparation of slide / material- **G** 03
6. Practical Record 10

1	A		Prep Procedure Sk	03 02 02 <hr/> 07	Reg. No. of Candidates Assigned
2	B		Calibration Result	02 02 <hr/> 04	
3	C		08	4+4=	Reg. No. of <u>absentees:</u>
	D				
4	E		ID 01 Sk 01 Description	02 <hr/> 04	<u>Total examined:</u>
	F				
5	G		ID 01 Sk Reasons	01 <hr/> 01	<u>Examiners:</u> 1.External  2.Internal
			03		
6		Class Record		10	

**Instruction to Examiners:**

A Onion r oot tip

B Onion/ Rheo leaf peel

C and D - one problem each from Mendelism and interaction of genes (May be dictated from the record book of students)

E and F one slide each from mitosis and meiosis

G any slide of ergastic substance mentioned in the syllabus

**Mangalore University**  
**B.Sc. VI Semester Course-1-Practical Examination**  
**Plant Physiology**  
**Question paper and Scheme of evaluation**

Time: 3 hrs. Batch..... Date..... Time.....am/pm Max. Marks: 40

1. List out the materials required for the major experiment- **A**. Write the procedure and principle of the experiment, draw a labelled sketch of the set up, set up the experiment and demonstrate the results. Draw the inference. Leave the set up for inspection. 12

2. Write the aim, procedure, diagram, the expected results and the inference of the minor experiments- **B** and **C** Procedure) 5+5=10

3. Estimation of carbohydrate/protein from the given sample D. 08

4. Record 10

1	A		Requirements 01 Sk 02 Procedure 02 Principle 01 Setting 04 Results and Inference <u>02</u> 12	Reg. No. of Candidates Assigned
2	B		Aim 01 Sk 01 Procedure 02	<u>Reg. No. of absentees:</u>
	C		Result & Inference <u>01</u> 05	
3	D		Procedure 04 Result & Conclusion 04 <u>08</u>	<u>Total examined:</u>
6		Class Record	10	<u>Examiners:</u> 1.External 2.Internal

**Instruction to Examiners:**

A One major experiment as per lots

B and C - any two minor experiments

D protein or carbohydrate

**Mangalore University**  
**B.Sc. VI semester Course 2-Practical Examination**  
**Plant Propagation, breeding and Biotechnology**  
**Question paper and Scheme of evaluation**

Time: 3 hrs.    Batch.....    Date.....    Time.....am/pm Max. Marks: 40

1. Estimate the percentage of pollen viability in the given flower **A** by hanging drop method. 08
2. Demonstrate-----in the given material **B**. Show the preparation to the examiner. 05  
 Draw a labelled diagram
3. Prepare synthetic seeds by alginate encapsulation method using provided embryo **C**. Show the preparation to the examiner , Write the procedure. 05
4. Identify and comment on **D, E** and **F**. 4+4+4=12
5. Record 10

1	A		Requirements 01 Procedure 02 Setting 03 Results <u>02</u> 08	Reg. No. of Candidates Assigned	
2	B		Preparation 03 Sk <u>02</u> 05		
3	C		Preparation 03 Sk <u>02</u> 05		
4	D		Identification 01 Sk 02		<u>Reg. No. of absentees:</u>
	E		Comments <u>02</u> 05		
	F				
5		Class Record	10	<u>Total examined:</u>  <u>Examiners:</u> 1.External  2.Internal	

**Instruction to Examiners:**

A Unopened flowers (*Datura/Catharanthus/Alamanda*) with intact anthers must be provided  
 B layering/ grafting/ emasculation

C Green embryo removed from fresh seeds must be provided  
 D , E and F Equipments or, photographs related to tissue culture, biotechnology

## Elective Course 1

### BSCBOCE 133: Mushroom Cultivation Technology

Unit	Topics	Teaching Hours
I	<p>Introduction – Edible and non-edible mushrooms. Edible mushrooms commercially cultivated in India – <i>Volvariella volvacea</i>, <i>Pleurotus citrinopileatus</i> and <i>Agaricus bisporus</i>.</p> <p>Cultivation Technology: History. Infrastructure- substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, stove, sieves, culture rack, mushroom unit (Thatched house), water sprayer, tray. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, banana leaves, areca sheath and coconut leaves. Composting technology in mushroom production.</p>	12
II	<p>Storage and nutrition: Short-term storage (Refrigeration – upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions.</p> <p>Chemical composition and their nutritional values : Proteins - amino acids, minerals, carbohydrates, vitamins and crude fiber.</p> <p>Food Preparation: Types of foods prepared from mushrooms. Research Centers - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.</p>	12

#### References:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, PankajKapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

## Elective Course II

### BSCBOCE 183: Herbal Technology

Unit	Topics	Teaching Hours
I	Medicinal Plants: History and scope, role of medicinal plants in traditional and modern systems of medicine; Medicinal plant cultivation and trade – global and Indian scenario. Pharmacognosy - systematic position, medicinal uses, active principles and pharmacognostic features of the following: <i>Ocimum sanctum</i> , <i>Gingiber officinale</i> , <i>Trigonella graceum</i> , <i>Phyllanthus emblica</i> and <i>Saraca asoca</i> General methods of herbal extraction with examples.	12
II	Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).	12

#### References:

1. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book - Distributors.
- 2 Herbal plants and Drugs Agnes Arber, 1999.Mangal Deep Publications.
3. Ayurvedic drugs and their plant source. V.V. Sivarajan and BalachandranIndra 1994. Oxford IBH - publishing Co.
4. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998.Banarsidass, Delhi.
5. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
6. Pharmacognosy, Dr.C.K.Kokate et al. 1999. NiraliPrakashan. of Indian medicinal plants,

## Elective Course III

### BSCBOCE 233: Vegetative and Reproductive Morphology of Angiosperms

Unit	Topics	Teaching Hours
I	Angiosperms: Introduction, parts of plant body and their functions. Roots- Types, modifications and functions. Stem- types, modifications and functions. Leaf – Morphological structure and types, phyllotaxy, modifications and functions. Inflorescence- types.	12
II	Flower - General structure, insertion of floral parts; calyx, corolla and their variations. Androecium-structure and its variations. Gynoecium- structure and its variations. Fruits and their types Seeds – structure of dicot and monocot seeds; albuminous and exalbuminous seeds.	12

#### References:

1. Akhil Baruah, 2008. Advanced morphology of Angiosperms, Aavishkar Publishers, New Delhi.
2. Narayana Rao B.N. 1972. Plant Modifications, Wisdom Publications, Mysore.
3. Singh, Pandey and Jain, 2010. A text book of Botany, Rastogi Publications.
4. Eams A.J. 2011, Morphology of Angiosperms, Nabu Press
5. Pandey, B.P., 2007. Botany for Degree Students, S. Chand Publishers.

## Elective Course IV

### BSCBOOE 283: Plant Diversity for Human Welfare

Unit	Topics	Teaching Hours
I	<p><b>Diversity and values of Plants:</b> The Concept of Biodiversity, types of biodiversity-genetic, species and ecosystem diversity. Species diversity of plants – global, Indian and Karnataka. General values of plants and forests with examples- ethical value, consumptive use value, productive use value, ecosystem services value, aesthetic value and optional use value.</p> <p><b>Plants as sources of food and medicine:</b> Plants as sources of protein, carbohydrate and dietary fibres. Agrobiodiversity and its importance. Brief history of domestication of rice. Plant based medicinal systems – Ayurveda, sidda, unani and folk medicine. Diversity of medicinal plants of India. Plants in beauty care. Contribution of medicinal plants to modern medicine – Important plant derived modern medicines and their uses. History of development of <i>Rauwolfia serpentina</i>, <i>Cinchona officinalis</i> and <i>Catharanthus roseus</i> based drugs.</p>	12
II	<p><b>Plants in industry, culture and climate regulation:</b> Industrially and commercially important plants and their products- paper, rubber, timber, cane, spices, beverages and sugar. Plants as sources of biofuel. Garden and ornamental plants. Religious and cultural use of plants. Role of plants and forests in climate and environment regulation- carbon sequestration and control of global warming, pollution control, regulation of water cycle and water purification.</p> <p><b>Conservation of plant diversity:</b> Major threats to plant diversity and forests- habitat destruction, over exploitation and natural extinction. Rates of plant extinctions with examples. Concept of endangered and endemic plants. Methods of plant and forest conservation- botanical gardens, sacred groves, reserve forests, national parks and biosphere reserves.</p>	12
<b>Total</b>		<b>24 Hours</b>

#### SELECTED REFERENCE BOOKS:

1. Sharma O.P., 2015. Plants and Human Welfare. Pragathi Prakashan
2. S.K .Jain, 1995. Manual of Ethnobotany. Scientific publishers.
3. S. Sundar Rajan-2007. College Botany Vol-V, Part 1:Taxonomy and Economic Botany Himalaya Publishing House.
4. Susil Kumar Mukharjee-2004. College Botany Vol-III. New Central Book agency, London
5. P.Vasanth Kumar 2014. Economic Botany. Sonali Publications New Delhi.



6. Erach Bharucha, 1998. Environmental Studies for UG Students. Universities Press, New Delhi.
7. Jain S. K. 2000. Human aspects of plant diversity. Economic Botany 54: 459 (article).

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