

**ST. JOSEPH'S COLLEGE,
BANGALORE- 560 027 (AUTONOMOUS)
I B.Sc. Botany Course
Semester – I - BO-115
(Theory paper I)
Microbiology and Algae
(60 Hours)**

Microbiology:

Unit I	Historical account of microbiology: Brief contributions of Anton van Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner and Alexander Flemming. Scope of Microbiology	03 hrs
Unit II	Viruses: General characteristics, classification based on genetic material; Structure and multiplication of HIV. Immunology: Antigen-antibody reaction, T cell – B cell function, Innate and acquired immune system, Monoclonal antibody – Hybridoma technique, vaccines, hypersensitivity, autoimmunity, Brief account of Viroids and prions.	10 hrs
Unit III	Bacteria: General characteristics of bacteria. Physical and chemical structure of Gram positive and Gram negative bacterial cell walls. Structure of capsule, flagella, pili and endospore. (Ultrastructure of flagella and endospore only) Reproduction by binary fission, Conjugation (F+ and F-, Hfr types), Transduction (generalized and specialized types) and Transformation. A brief account of transposons. A brief account of importance of bacteria in Agriculture, industries, medicine and environment.	10 hrs
Unit IV	Mycoplasma: General characteristics, structure and reproduction	01 hr
Unit V	Plant diseases: A general account of symptoms caused by viruses, bacteria and mycoplasma. Study of TMV, citrus canker, sandal spike. (Etiology, disease symptoms, vectors and control measures only)	03 hrs

Unit VI	Cyanobacteria: General characters and Economic importance of Cyanobacteria. Structure and reproduction of <i>Anabaena</i> , <i>Scytonema</i> , <i>Spirulina</i> .	04 hrs
Unit VIII	Diversity of Algae : Habitat, thallus organization and reproduction ; Life cycles in algae: Haplontic, diplontic, haplobiontic and diplobiontic types	12 hrs
Unit IX	Systematic position, structure and reproduction of the following forms: a) Volvox b) Hydrodictyon c) Spirogyra d) Chara e) Vaucheria f) Sargassum g) Batrachospermum Economic importance of algae. (Chlorophyceae, Rhodophyceae, Phaeophyceae)	15 hrs
Unit X	Economic importance of algae. (Chlorophyceae, Rhodophyceae, Phaeophyceae)	02 hrs

PRACTICALS	<p>BO 1P₁</p> <ul style="list-style-type: none"> • Gram staining of bacteria (<i>Rhizobium</i>, <i>Lactobacillus</i>) • Haemocytometry (yeast). • Demonstration of motility in bacteria by hanging drop technique. • Study of Cyanobacterial forms: <i>Anabaena</i>, <i>Scytonema</i>, <i>Spirulina</i>. • Study of plant diseases: Citrus canker, sandal spike, grassy shoot of sugarcane, tobacco mosaic. • Algae-Study of morphology and reproduction of forms studied in theory. • Demonstration of <i>Spirulina</i> culture • Submission of algal specimens (any three) • Submission of Scrap book related to Unit I
REFERENCES	<ul style="list-style-type: none"> • Smith,G.M.,1955. Cryptogamic botany vol 1.Kogakusha company Ltd., Japan. • Vashishta,B.R.,1976.Botany for degree students Part 1.Algae,S.Chand and company, New Delhi. • Kumar,H.D.,1990.Introductory phycology East Western Press,New Delhi. • Srivastava H.N 1998, Algae ,Pradeep publications, Jalandar • Sundarajan,S.1998 College Microbiology Vol 1,Vardhana publications,Bangalore. • Pelezar, Michael J, Chan and Krieg,1993. Microbiology, Tata McGraw Hill pub.Co.Ltd, • New Delhi. • Chopra,G.L.1973,text book of algae,S.Nagin and co.Jalandhar. • Schlegel H.G.1993,General Microbiology,VIIEd.Cambridge.Univ.Press,England. • Volk and Wheeler ,1980,Basic Microbiology IV Ed.J.B.Lippincott company,Philadelphia. • Benson,H.J.1990,Microbiological Applications,a lab manual in general Microbiology,Wm.C.Brown Publishers.

ST. JOSEPH'S COLLEGE, (AUTONOMOUS)
I B.Sc. Botany Course
Semester – II BO-215
Theory: Paper II
Diversity of non-vascular plants (Fungi, Plant Pathology,
Bryophytes and Anatomy)
(60 Hours)

Unit 1	Fungi	
	General characteristics , habitat ,structure and reproduction of fungi	05 hrs
	Outline of classification according to G.C.Ainsworth (1973)	01 hr
	Detailed study of morphology and reproduction of <i>Pythium</i> , <i>Rhizopus</i> , <i>Peziza</i> , <i>Puccinia</i> , <i>Agaricus</i> and <i>Fusarium</i> .	12hrs
	Economic importance of fungi	02 hr
	General account of Lichens and Mycorrhizae and their significance	04 hrs
Unit II	Plant Pathology	06 hrs
	Etiology, symptoms, disease cycle and control measures of club root of crucifer, Koleroga of Areca, Smut of jowar, Tikka of groundnut, Blast of rice, Red rot of sugarcane.	
Unit III	Bryophyta	15 hrs
	Distribution, general characters, alternation of generations and classification of Bryophytes. Morphology, anatomy and reproduction of <i>Marchantia</i> , <i>Anthoceros</i> , <i>Funaria</i> (developmental details not required); economic importance of Bryophytes	
Unit IV	Anatomy	
	Meristems –Classification, theories of organization (Apical, Histogen, Tunica-Corpus) and cytohistological zonations	04 hrs
	Secretory tissues-types, structure and importance	02 hrs
	Secondary Growth:Dicot stem	02 hrs
	Anomalous secondary growth in <i>Boerhaavia</i> and <i>Dracaena</i>	03 hrs
	Wood anatomy: Variation in wood structure: ring porous and diffuse porous	04 hrs
	Wood parenchyma ; uniseriate and multiseriate rays, apotracheal and paratracheal parenchyma	

PRACTICALS

BO 2P1

- Study of *Pythium*, *Rhizopus*, *Peziza*, *Puccinia* and *Agaricus*, *Fusarium*, Lichens, Mycorrhizae; Club root, Koleroga, Smut, Tikka, Blast, Red rot diseases.
- Study of *Marchantia*, *Anthoceros* and *Funaria*.
- Anatomy of dicot and monocot stem and root.
- Anomalous secondary growth in *Boerhaavia* and *Dracaena*

Student's submission: 3 Herbarium sheets of diseased plants.

Activity: Cultivation of Oyster/milky mushroom

REFERENCES:

- Dube H.C, 1983; An Introduction of Fungi.Vikas publication house,New Delhi.
- Mehrotra R.S & K.R.Aneja 1990. An introduction of Mycology.
- Vasishta B.R, 1981; Botany for degree students Part II Fungi.S.Chand company
- Srivastava, H.N(1993) Fungi,Predeep Publications,Allahabad
- Bilgrami K.S and Dube H.C.(1976).a text book of modern plant pathology.Vikas Publication House,New Delhi.
- Parihar, N.S.(1962), Bryophyta,Central book depot,Allahabad.
- Srivastava, H.N(1993), Bryophyta,Predeep Publications, Allahabad.
- Watson.E.V.(1971)The structure and life of Bryophytes,Hutchinson and Co.,London.
- Fahn, A (1969) Plant Anatomy 2nd Edition, Wiley, New York.
- Easu, K (1979) Anatomy of seed plants. Wiley Eastern Ltd. New Delhi.
- Singh R.S(1984).Introduction to principles of plant pathology,Oxford and IBH Publication Co.Pvt.Ltd.New Delhi.
Sundararajan.S(1993),College Botany Vol I & II.Himalaya Publishing company.Bangalore

ST.JOSEPH'S COLLEGE, (AUTONOMOUS)
BANGALORE- 560 027
II B.Sc. Botany Course Semester – III BO-315
Pteridophytes, Gymnosperms and Paleobotany.
THEORY: Paper III (60 hours)

Unit I	BIODIVERSITY OF PTERIDOPHYTES(30hrs)	
	A general account of characteristics, distribution and affinities of Pteridophytes. Classification (Smith,1955).	02 hrs
	Systematic position, sporophytic structure, reproduction and life cycle of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Equisetum</i> , and <i>Marselia</i> . (development details not expected)	15 hrs
	Brief account of Stellar evolution, Heterospory and Seed habit	05 hrs
	Study of fossil Pteridophytes : <i>Rhynia</i> , <i>Lepidodendron</i> and <i>Calamites</i>	08 hrs
Unit II	GYMNOSPERMS (15 hrs)	
	A general account and classification (Sahani, Pant and Sporne)	04 hrs
	Salient features of Cycadales, Coniferales and Gnetales.	
	Details study of the structure and reproduction of	05+05 hrs
	a) <i>Pinus</i>	
	b) <i>Gnetum</i>	
	(Developmental details not required except male and female gametophytes)	
	Economic importance of Gymnosperms	01 hrs
Unit III	PALEOBOTANY (15 hrs)	
	Types of rocks.	02 hrs
	Types of fossils	02 hrs
	Geological time scale; Determination of age of fossil.	02 hrs
	Techniques of studying fossils.	03 hrs
	A brief account of fossil genera :	04 hrs
	a) <i>Glossopteris</i>	
	b) <i>Pentoxylon</i>	
	Application of palaeobotany in prospecting fossil fuels	02 hrs

Practicals

BO3P1

- Study of morphological and anatomical features of vegetative and reproductive parts of the Pteridophyte forms mentioned in the theory for the purpose of identification and classification
- Study of the fossil members (Pteridophytes and Gymnosperms) as mentioned in the syllabus with the help of slides/specimen
- Study of *Pinus* -external and internal morphology and reproductive structures
- Study of *Gnetum* -external and internal morphology and reproductive structures
- Micropreparation (a specimen each from pteridophytes and gymnosperms)
- Types of rocks

References

- The morphology of Pteridophytes by K.R.Sporne, Hutchinson Co., London (1970).
- Pteridophytes by Rasheed, Vikas Publication, New Delhi.
- Cryptogamic Botany Vol. II McGraw – Hill, New York.
- The morphology of Pteridophytes by N.S.Parihar. Central Book Depot, Allahabad.
- Morphology of vascular plants (lower groups) by Eames, A.J.1936. McGraw Hill, New York.
- Studies in Paleobotany, Andrews, H.N. 1961. John Wiley, New York.
- Andrews H.N. 1961 Studies in Paleobotany. John Wiley & Sons New York.
- Baja Y.P.S. (ed) 1989. Biotechnology in Agriculture and Forestry Vol. 5. Trees II. Springer – Verlag, Berlin, Heidelberg.
- Chamberlain C.J. 1935. Gymnosperms. Structure and evolution. Univ, Chicago Press, Chicago.
- Coulter, J.M. & Chamberlain C.J. 1917 Morphology of Gymnosperms. Univ Chicago Press, Chicago.
- Bhatnagar S.P. and Alok Mitra 1966 Gymnosperms. New age International (P) Ltd. Publishers.
- Sporne K.R. 1974 The Morphology of Gymnosperms. Hutchinson Univ. Lib. London.
- Shripad N. Agashe 1995 – Paleobotany. Oxford and I.B.H. New Delhi.
- Dutta S.C. 1966 An Introduction to Gymnosperms. Asia Publications House, Mumbai.

ST.JOSEPH'S COLLEGE,BANGALORE- 560 027
(AUTONOMOUS)
II B.Sc. BOTANY COURSE
SEMESTER – IV BO-415.
Embryology of Angiosperms,
Palynology and Environmental Biology
THEORY: paper IV (Intradepartmental)
(30 hrs)

Unit I	Introduction Development and structure of anther Development of male gametophyte	04 hrs
Unit II	Types of Ovule. Structure of an anatropous ovule. Variations in ovule structure- Aril, integumentary tapetum, caruncle	03 hrs
Unit III	Different types of Embryosac development: (Monosporic- <i>Polygonum</i> type; Bisporic- <i>Allium</i> type and Tetrasporic- <i>Fritillaria</i> type. Double Fertilization and its significance	04 hrs
Unit IV	Differences between mature Dicot and Monocot embryos Types of Endosperm : i) Nuclear ii) Cellular iii) Helobial	02 hrs
Unit V	IN VITRO MORPHOGENESIS. Concepts in brief- totipotency, Differentiation, dedifferentiation, redifferentiation and morphogenesis. Organ culture: Embryo culture and its significance	03 hrs
Unit VI	PALYNOLOGY Pollen morphology: Apertures, exine stratification and Ornamentation.	03 hrs
Unit VII	ENVIRONMENTAL BIOLOGY Ecology : Introduction sub-divisions Ecological factors: a) Climatic- temperature, and light. Edaphic - soil profile. Edaphic factors affecting vegetation(soil water, soil microbes, and pH)	01 hr

Biotic factors- (definition with examples)

- a) Commensalism (epiphytes and lianas).
- b) Protocooperation (Bacteria)
- c) Mutualism (Rhizobium, lichens and Mycorrhiza)
- d) Parasitism (Cuscuta, Rafflesia, Viscum and Santalum)
- e) Allelopathy (Eucalyptus)

05 hrs

Unit VIII Ecosystem: definition, components, food chain, food web and ecological pyramids.

04 hrs

Ecosystems study: types, ocean and tropical rain forest ecosystem.

Ecological successions: Hydrosere and xerosere

Unit IX Global environmental issues; Acid rain, Green house effect, and Ozone layer depletion

01 hrs

Practicals BO4P1: Based on theory 3x10=30hrs

1. T.S of Young and mature anther
2. Whole mounts of pollen grains of – Grass, Cocos, Mimosa, Acacia, Tridax, Eucalyptus and Pollinia of Calotropis
3. Germination of Pollen grains of Vinca (*in vitro*) –Hanging Drop method
4. Placentation and its types
5. Types of Ovule
6. Mounting of endosperm using *Cucumis*
7. Mounting of embryo using Tridax
8. Study of morphological and anatomical features of:-
 - a) Halophytes b) epiphytes c) xerophytes d) parasites
9. Estimation of chloride in water samples using Harvey's method
10. Estimation of oxygen in water samples using Winkler's method

References:

- Bhojwani & Bhatnagar S.P. 1992: The Embryology of angiosperms, Vikas Publication House, New Delhi.
- Johri, B.M.(Ed) 1984: Embryology of angiosperms. Springer Verlag, Berlin.
- Maheshwari P. 1950 : An Introduction to the embryology of angiosperms – Tata McGraw Hill, New Delhi.
- Razdan M.K. 1993 : An Introduction to plant tissue culture. Oxford and IBH Delhi.
- Erdtman, G. (1969) Handbook of Palynology. Hafner Pub. Co. New York.

- Agashe S.N. (2006) Palynology and its application. Oxford and I B H Pub. Co. Pvt. Ltd.
- Gregory, P.H. (1973) The Microbiology of the Atmosphere.
- Ogden, Raynor, Hayes, Lewis and Haines (1974). Manual for sampling Air borne pollen. Hafner Press (A division of Macmillan Publ. Co. inc. New York, London)
- Sharma P.D. 1999 – Ecology and Environment. Rastogi Publications.
- Kumar H.D. 1955 – Modern Concepts of Ecology. Vikas Publishing House, Private Limited.
- Odum, E.P. 1970 – Fundamentals of Ecology
- Purohit S.S. 2002 – Ecology, Environment and Pollution.
- Jogadand – Environmental Biotechnology.
- Agashe, S.N. (1995) Paleobotany. Oxford and I B H Pub. Co. Pvt. Ltd.

CBCS for B.Sc - Interdepartment Elective – Botany
BO OE-4116: Applied Botany (30 hrs)

I. Ethnobotany (Tribal knowledge about plants) 08 hrs

Introduction, scope and objectives

Plants used as: a) Food b) medicine c) intoxicants and beverages d) Resins and oils

II. Biofertilizers and Biopesticides 07 hrs

General account of microbes used as biofertilizers and biocontrol agents.

Organic farming, terrace gardening and soil less agriculture

Compost making: Types, methods, vermi-composting and its applications.

III. Mushroom Cultivation 15 hrs

Introduction, nutritional and medicinal value of edible mushrooms. Poisonous mushrooms.

Cultivation: mushroom spawns, grain spawn production, mushroom farm layout and mushroom shed; sanitation.

Steps in cultivation of oyster mushrooms (preparation of substrate, spawning, spawn running, cropping and harvesting).

White button mushroom cultivation (substrate compositions, substrate preparation: outdoor and indoor composting, filling the compost, pasteurising, spawning, spawn running, casing, cropping and harvesting).

Processing and storage practices of mushrooms.

Pests and disease control; economics of mushroom cultivation.

Student activity: A report on a visit to biofertilizer production centres/ mushroom growing unit/ organic farms /Assignment

References:

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand& Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John JothiPrakash, E. 2004. Outlines of Plant Biotechnology.Emkay -Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. SubhaRao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming AktaPrakashan
7. Bahl, N. 1988. Handbook of Mushroom.Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi 37
8. Krishnamoorthy, A.S., Marimuthu, T. and Nakkern, S. 2005 Mushroom Biotechnology .TNAU Press, Coimbatore, India
- 9.Harander, S. 1991. Mushrooms.The Art of Cultivation Sterling Publishers.
10. Tripathi, D.P. 2005. Mushroom Cultivation.Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

St. Joseph's College Autonomous,
Bangalore – 560 027
III B.Sc. – BOTANY COURSE
Semester V
BO 5115 : Taxonomy of Angiosperms
(45 hrs)

Unit I	Introduction to plant taxonomy, contributions of Carl Linnaeus. Systems of classification : Bentham and Hooker's system, Engler and Prantl's system("Syllabus der Pflanzenfamilien", ed. Melchior,1964)	4 hrs
Unit II	ICBN to I C N – definition, the requirement of a code for Botanical Nomenclature and principles of ICN; Typification	2 hrs
Unit III	Modern systematics – Need for a synthetic approach, role of palynology, phytochemistry and serology in taxonomy; DNA bar coding	3 hrs
Unit IV	Herbaria and herbarium techniques, Botanical gardens and their importance	4 hrs
Unit V	Vegetative and floral characters of flowering plants used in taxonomy in the description of families. Salient features of the families given below –(according to Engler & Prantl "Syllabus der Pflanzenfamilien", ed. Melchior, 1964). <u>Dicotyledon families</u> : Magnoliaceae, Moraceae, Brassicaceae, Malvaceae, Papilionaceae, Rutaceae, Euphorbiaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Scrophulariaceae, Lamiaceae, Rubiaceae, Cucurbitaceae and Asteraceae. <u>Monocotyledon families:</u> Poaceae, Liliaceae, Cannaceae, Musaceae and Orchidaceae. Brief economic uses of the members of the above mentioned families	32 hrs

Practicals BO 5P1

- Detailed studies of the families mentioned in the theory with two or at least one locally available examples.
- Preparation and submission of **ten** herbarium specimens from any Ten families.
- Economic Botany:

Common name, botanical name, family to which they belong, morphology of the part being used and uses of

- a) Cereals and Millets : Rice, Wheat, Jowar, Ragi
- b) Pulses : Black gram, Bengal gram, Green gram
- c) Spices : Cardamom, Clove, Cinnamon.
- d) Fibres : Cotton, Coir and Jute
- e) Paper and Pulp : Eucalyptus and Bamboo
- f) Sugar : Cane Sugar
- g) Beverages : Coffee and Tea
- h) Medicinal plants: Neem, Sarpagandha and Periwinkle.

- Submission of five economically important plant products.

Local field trip for studying plants and plant specimen collection

- ## **References**
- Ashok Bendre and Ashok Kumar (1980) Economic Botany Meerut: Rastogi and Publications.
 - Heywood V.H. (1967) Plant Taxonomy, London: Edward Arnold.
 - Hill A.F. (1982) Economic Botany, New York: McGraw Hill.
 - Jeffrey C. (1968) An introduction to plant taxonomy, London.
 - Lawrence, F.H.M. (1969) Taxonomy of vascular plants, New Delhi, Oxford & IBH.
 - Singh and Jain, D.K. (1989) Taxonomy of angiosperms, Meerut, Rastogi publications.
 - Sundararajan, S. (2000) College Botany Vol. III Mumbai: Himalayan Publishing House.
 - Sivarajan, V.V. (1982) Introduction to principles of plant taxonomy. New Delhi: Oxford & IBM Publications.
 - B.S.Sharma and B.B. Trivedi (1978) Introductory taxonomy, L B Publications

**ST.JOSEPH'S COLLEGE AUTONOMOUS,
BANGALORE- 560 027**

III B.SC. BOTANY COURSE

SEMESTER – V

**BO-5215 : Molecular Biology and Plant Biotechnology
(45 hrs)**

Unit I	Molecular biology: a) DNA as genetic material (Griffith's experiment; Avery, Mcleod and McCarty experiment, Hershey Chase experiment) organization, function and methods of replication (eukaryotic). b) RNA: Genetic and Non-genetic, structure and function, a brief account of Ribozymes. c) Central dogma of molecular biology. Genetic code, protein synthesis in Eukaryotes. d) Benzer's concept of gene e) Eukaryotic gene regulation (Britten-Davidson model)	16hrs
Unit II	DNA amplification by PCR technique and Sanger's method of sequencing. Southern blot technique, tools of genetic engineering, restriction endonucleases, ligases, vectors (pUC18, λ phage), <i>Agrobacterium tumefaciens</i> mediated biotransformation in crop plants.	12hrs 08 hrs
Unit III	Plant biotechnology a) Transgenic plants : A brief account of - Golden Rice, Flavr Savr Tomato, Petunia (ornamental) and Bt Cotton b) Molecular farming using tobacco as model plant Brief concept of molecular pharming, secondary metabolites in plants (alkaloids and flavonoids with 2 examples each) and their importance in medicine Edible plant vaccines Gene silencing and termination gene technology	12 hrs
Unit IV	Production of drought, salinity and disease resistant plants Biological nitrogen fixation in non-leguminous plants	5hrs
Unit V	Patenting, IPR and its perspectives Biosafety and biohazards	3hrs

PRACTICALS BO 5P₂

1. Qualitative tests for primary metabolites from plants. (Reducing Sugars, Starch, Aminoacids, Proteins and Lipids.)
2. Qualitative test for secondary metabolites from plants. (Phenols , Alkaloids, Flavanoids, Saponins, Anthocyanins etc.)
3. Quantitative estimation of Reducing sugars by colorimetry.
4. Determination of ascorbic acid content of plant sample.
5. Demonstration of oxidase, peroxidase activity in potato/brinjal/apple.
6. Isolation of DNA from plant samples.
7. Estimation of DNA by DPA method
8. Estimation of protein by Lowry Lopez method
9. Spotters from molecular biology
10. Spotters from plant biotechnology

References

- Brown, T.A., 1990. Gene cloning, Chapman & Hall.
- Friefelder, D., 2000. Molecular Biology, 2nd edition. Jones and Bartlett publishers, Boston.
- Grierson, D. 15 and Covey, S.N., 1988. Plant Molecular biology, 2nd edition, Blackie, Chapman and Hall, New York USA.
- Lewin, B., 2000. Genes VIII, Pearson Prentice Hall
- Kahl, A. and Schell, J.S., 1982. Molecular Biology of plant tumour, Academic Press, New York.
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- T. A. Brown (2010), Gene cloning and DNA analysis, 6th edition, Wiley and Blackwell publishers

**ST. JOSEPH'S COLLEGE, (AUTONOMOUS),
BANGALORE - 560027
III B.SC. BOTANY COURSE
SEMESTER – VI**

BO-6115 : PLANT PHYSIOLOGY (45Hrs)

Unit I	<p>Water relations of plants : 2 hrs</p> <p>Diffusion, osmosis, imbibition, plasmolysis, water potential and its components.</p> <p>Absorption of water and ascent of sap: 3 hrs</p> <p>The mechanism of water absorption, factors affecting the rate of water absorption. Ascent of sap: Pulsation theory of J.C. Bose and Transpiration pull and cohesion-tension theory of Dixon and Jolly.</p> <p>Transpiration: 3 hrs</p> <p>Stomatal opening and closing mechanism : K⁺ ion theory Role of Transpiration in growth and development, factors influencing transpiration, antitranspirants, guttation.</p>	
Unit II	<p>Mineral nutrition of plants: 4 hrs</p> <p>Elements composition of plants. The essential elements and their functions, symptoms of deficiency, ion antagonism; hydroponics, aeroponics and foliar nutrition.</p> <p>Absorption of mineral salts: Ion uptake mechanism, factors affecting mineral uptake, ion channels.</p>	
Unit III	<p>Phloem transport: 3 hrs</p> <p>Transport of organic solutes (use of radioactive isotopes, tracer, and autoradiography), vein loading and unloading; transport mechanism (protoplasmic streaming hypothesis, Mass flow hypothesis). Factors affecting phloem transport.</p> <p>Biological Nitrogen Fixation in leguminous plants 2 hrs</p>	
Unit IV	<p>Photosynthesis: Bioenergetics – Laws of thermodynamics, structure of chloroplast and Ultrastructure of thylakoid membrane, principles of light absorption, photosystems I and II . Photosynthetic electron transfer and photophosphorylation, mechanism of ATP synthesis (Chemiosmotic hypothesis), mechanisms of carbon fixation and carbohydrate synthesis, C₃ cycle, C₄ pathway, CAM pathway. Factors affecting the rate of photosynthesis and Blackmann's law of limiting factors.</p>	10 hrs
Unit V	<p>Photorespiration: Mechanism, organelles involved and significance</p> <p>Respiration : Ultrastructure of cristae, Respiratory Quotient, Glycolysis, TCA cycle, ETS and Oxidative phosphorylation, anaerobic respiration (alcoholic fermentation), Pentose phosphate pathway – significance. Factors affecting the rate of respiration.</p>	9hrs

Unit VI	Plant growth and photobiology :	9 hrs
	Definition of growth, sigmoid growth curve, growth regulators – Auxins, Gibberellins, Cytokinins, Abscissic acid and Ethylene - their role in growth and development	
	Plant movements.	
	Dormancy, seed viability and germination.	
	Phytochrome and its role in growth and development, Photoperiodism, vernalization, Florigen concept and Biological clocks.	

Practicals BO 6P1

1. Observation of plasmolysis and determination of osmotic potential by plasmolytic method
2. Study of stomatal types and determination of Stomatal Index in monocot and dicot leaves
3. Demonstration of suction force and estimation of rate of Transpiration using Ganong's potometer.
4. Setting up of Solution culture/ hydroponics for demonstration of deficiency syndrome
5. To study the effect of temperature on membrane permeability. Extraction of phloem sap and estimation of the constituents
6. Separation of photosynthetic pigments by paper chromatography and finding their R_f values
7. Effect of different wave lengths of light and CO₂ concentration on photosynthesis
8. Demonstration of RQ using Ganong's respirometer; anaerobic respiration and fermentation.
9. Effect of synthetic growth regulators on plants (demonstration only)
10. Study of hydrotropism, phototropism and geotropism.

- References**
- Salisbury F.B. and Ross C.W. 1986. Plant Physiology. CBS Pub. New Delhi.
 - Srivastava, H. N, (2007). Plant Physiology, Rastogi Publications
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 - Moore, T.C., 1989. Biochemistry and Physiology of Plant hormones, Narosa Pub. House, New Delhi.
 - Singh, B.N., & Mengel, K., 1995. Plant physiology and biochemistry, Panima Pub. Corporation, New Delhi.
 - Singal, G.S., Genger, G.C., Sopory, S.K., Irrgang, K.D., & Govindjee, 1999. Concepts in photobiology, photosynthesis and photomorphogenesis, Narosa Pub. House, New Delhi.
 - Stumpf, P.K., & Conn, E., (eds) 1988. The biochemistry of plants - A comprehensive treatise, Academic Press, New York.

**ST.JOSEPH'S COLLEGE, (AUTONOMOUS),
BANGALORE- 560027
III B.SC. BOTANY COURSE
SEMESTER – VI
BO-6215 : Cytology, Genetics, Plant breeding & Propagation
(45 hrs)**

Unit I	<p>CYTOLOGY (18hrs)</p> <p>Chromosomes: General Structure, types of chromosomes based on position and number of centromeres. Concept of heterochromatin and euchromatin; Karyotype and Idiogram.</p> <p>Ultrastructure of chromosome: Nucleosome model</p> <p>Special chromosomes –Polytene and B Chromosomes in plants and its significance</p>	7 hrs
Unit II	<p>Chromosomal aberrations and their cytological and evolutionary significance:</p> <ul style="list-style-type: none"> • Numerical aberrations – euploidy and aneuploidy • Structural aberrations – deletion, duplication, inversion and translocation <p>Techniques to study chromosomes – Types of staining, chromosome painting, FISH</p>	11 hrs
UNIT III	<p>GENETICS (18 hrs)</p> <p>Introduction, Mendel's contributions, Mendelian principles and laws, Monohybrid, dihybrid and test cross.</p> <p>Deviations from Mendelian principles- Incomplete dominance, co-dominance and lethal genes</p> <p>Concept of epigenetic</p> <p>Non-allelic interactions - Supplementary and complementary genes.</p> <p>Epistasis, multiple factor and polymeric genes (plant examples only)</p> <p>Linkage, crossing over and their significance.</p> <p>Genetic mapping in maize. (Three point test cross)</p> <p>Sex determination in plants (<i>Melandrium</i>) , genic balance theory</p>	<p>3 hrs</p> <p>2 hrs</p> <p>5 hrs</p> <p>3 hrs</p> <p>1 hr</p> <p>1hr</p>
Unit IV	<p>Extrachromosomal inheritance:</p> <p>a) Cytoplasmic male sterility (Maize) b) mitochondrial inheritance (Petite yeast) and c) chloroplast inheritance (<i>Mirabilis</i>)</p>	3 hrs

Unit V	PLANT BREEDING AND PLANT PROPAGATION (9hrs)	
	Scope and objectives of plant breeding, contributions of M.S.Swaminathan	1 hrs
	Vegetative propagation – Natural (root, stem and leaf) and Artificial (cutting, grafting and layering)	3 hrs
	Techniques of crop improvement- selection, introduction, and hybridization.	2 hrs
	Hybridization : types - intervarietal, interspecific and intergeneric ; methods of hybridization –(pedigree, bulk, backcross, multiple cross); Techniques of hybridization ; mutation breeding	2 hrs
	Heterosis – types, effects and genetic basis Quarantine laws	1 hr

PRACTICALS

BO – 6P2

Cytology

1. Preparation of solutions and stains ; staining techniques
2. Study of permanent slides in Mitosis
3. Preparation and study of mitosis using root tips of *Allium cepa*.
4. Study of permanent slides in Meiosis
5. Preparation and study of meiosis using flower buds of *Allium cepa*.
6. Study of Karyotype of *Allium cepa*

Submission: Preparation of permanent slides in Mitosis (2) and Meiosis (3) (total 5 slides).

Plant breeding :

7. Natural vegetative propagation : root, stem and leaf modifications
8. Stem cutting, Layering (air layering, simple layering), Approach grafting and bud grafting – T budding

Genetic problems

9. Monogenic, digenic crosses and test cross
10. Interaction of genes

- REFERENCES**
- Strickberger, M.W. (1985). Genetics. 3rd Edn. MacMillan Pub. Co., Philadelphia
 - Gupta, P. K. (2011). Genetics. 4th Edn. Rastogi Pub., Meerut
 - Singh, B. D. (2002). Genetics. Kalyani Pub. Ludhiana.
 - Archana Sharma and Sumitra Sen (2002). Chromosome Botany. Oxford and IBH Pub. Co. New Delhi.
 - Cell biology – C. B. Powar.
 - Genes IX -- Benjamin Lewin
 - Gene and Genetic code – Gardner and Simmons
 - Cell and Molecular biology – S. C. Rastogi, Rastogi publications.
 - College Botany Vol. V & VI – Sundara Rajan S. Himalaya publications.
 - Principles of Genetics – by Sinnot, Dunn and Dobzhansky.
 - Cytology, Genetics, Evolution and Plant breeding – P.K. Gupta. Rastogi Publications
 - Cytogenetics, Evolution and Plant breeding – Shukla and Chandel
 - Cell biology – S.C. Ray and K. K. De.