

MASTER OF SCIENCE BOTANY

SYLLABUS

**Choice Based Credit System (CBCS)
2018-2020**



**FAKIR MOHAN AUTONOMOUS COLLEGE,
BALASORE**

DISTRIBUTION OF MARK
Mid Semester Examination
Full Marks-20

- | | | |
|----|---|-----------------|
| 1. | One Long Answer questions (LAQ)
with One Alternative | 12 marks |
| 2. | Two Short Answer Question (SAQ)
out of four options | 2 x 4 =08 marks |
| | | Total= 20 marks |

Example

- | | | |
|---------|--|------------------|
| Q. No-1 | LAQ
Or
LAQ | 12 marks |
| Q. No-2 | SAQ (Answer any two)
a.
b.
c.
d. | 2 x 4= 08 marks |
| | | Total = 80 marks |

End Semester Examination
Full Marks-80

Section-A

10 Short Answer Questions (SAQ) 12 marks
out of 12 Questions covering the entire Syllabus

Section-B

3 Long Answer Questions (LAQ) each 3 x 20= 60 marks
Question with one alternative set unit wise
Total= 80 marks

Example

Section-A

Q. No-1 SAQ (Answer any ten) 2 x 10= 20 marks

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.
- k.
- l.

Section-B

Q. No-2 Unit-I LAQ 20 marks
Or
LAQ

Q. No-2 Unit-II LAQ 20 marks
Or
LAQ

Q. No-2 Unit-III LAQ 20 marks
Or
LAQ

Total= 80 marks

CBCS Course Structure
Fakir Mohan Autonomous College, Balasore
2018-2020

Semeater	Paper	Paper Name	Credit	Marks in Each Semester		Total
				Mid Sem	End Sem	
1ST SEMESTER	I	Diversity of Plants-I	06	20	80	100
	II	Diversity of Plants-II	06	20	80	100
	III	Cell & Molecular Biology in Plants	06	20	80	100
	IV	Plant Biochemistry	06	20	80	100
	V	Practical Pertaining to Theory Papers-I, II, III, IV	06	-	100	100
						500
2ND SEMESTER	VI	Cytogenetics, Plant Breeding	06	20	80	100
	VII	Biotechnology	06	20	80	100
	VIII	Plant Physiology	06	20	80	100
	IX	Plant Taxonomy, Ecology	06	20	80	100
	X	Practical Pertaining to Theory Papers- VI, VII, VIII, IX	06	-	100	100
						500
3RD SEMESTER	XI	Plant Development & Reproduction	06	20	80	100
	XII	Conservation Biology	06	20	80	100
	XIII	Plant Physiology & Developmental Biology	06	20	80	100
	XIV	Plants & Environment	06	20	80	100
	XV	Advanced (Practical)	06	-	100	100
						500
4TH SEMESTER	XVI	Environmental Biotechnology-I	06	20	80	100
	XVII	Environmental Biotechnology-II	06	20	80	100
	XVIII	Economic Botany, Biostatistics, Evolution	06	20	80	100
	XX	Practical Pertaining to Theory Paper-XVIII	06	-	100	100
	XX	Project/ Dissertation	06	-	100	100
						500

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**FIRST YEAR
Semester- I**

Credit-6

F.M: 20+80=100

**PAPER-I
DIVERSITY OF PLANTS-I**

Unit- I

History and development of Microbiology, Bergey's manual for classification of microbes, Whittaker's 5 kingdom concept, Carl Woese's 3 domain classification, characteristics of prokaryotic and Eukaryotic microbes, isolation, culture and maintenance of microorganisms, Microbial growth, Roles of microbes in agriculture and industry, factors influencing growth of microbes.

Structure and reproduction of Eubacteria, Cyanobacteria, Archaea, Actinomycetes, Mycoplasma, Rickettsiae, Spirochaetes, Virus, Viroids, Prions, Biofertilizers, Cyanobacteria, Rhizobium, PSB, Mycorrhizae and Azotobacter.

Unit- II

Algae in diversified habitats (terrestrial, freshwater and marine), classification based on pigment, food reserve and flagella, thallus organization, reproduction, Life cycles in algae, Salient features of Chlorophyta, Bacillariophyta, Dinophyta, Phaeophyta and Rhodophyta, Algal bloom and toxins, Algae as food, seaweed cultivation.

Unit- III

Classification of fungi, structure and reproduction of Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, Degeneration of sex in fungi, nutrition in fungi, heterothallism, heterokaryosis.

Plant diseases caused by viruses, bacteria, mycoplasma and fungi, disease symptoms, modes of infection and dissemination, disease resistance, defense mechanism and control methods, host-parasite relationship, fungal toxins and their mode of action.

Semester- I

Credit-6

F.M: 20+80=100

PAPER-II

DIVERSITY OF PLANTS-II

Unit- I:

Origin, evolution and classification of Bryophytes, Ecological significance of bryophytes, structure and reproduction of Anthocerotales, Marchantiales, Metzgeriales, Jungermanniales, Sphagnales, Funariales and Polytrichales, Progressive sterilization of sporogenous tissues, evolution of gametophytes in bryophytes.

Unit- II:

Origin, evolution and classification of pteridophytes, General account of Psilophytales, fossil lycophytes, Sphenophytes, fossil ferns, Stellar evolution, Origin of heterospory, Heterospory and seed habit.

Structure, reproduction and evolution of Psilopsida, Lycopsida, Sphenopsida and Pteropsida, soral evolution, origin, morphology and evolutionary significance of sporocarp.

Unit- III:

Evolution and classification of Gymnosperms, Geological time scale, fossilization process, General account of Pteridospermales, Cycadeoidales, Pentoxyllales, Fossil Ginkgoales, Cordaitales and fossil Coniferales.

Structure and reproduction of Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales, Complexities and gametophytes in gymnosperm, Evolution of female gametophytes, variation in the structure of pollen grains.

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Semester- I

Credit-6

F.M: 20+80=100

PAPER-III

CELL & MOLECULAR BIOLOGY OF PLANTS

Unit- I:

Cell Wall: Structure & functions; biogenesis, growth.

Plasma membrane: Structure, models, electrical properties of membrane and functions, sites for ATPases, ion carries, channels and pumps; receptors.

Plasmodesmata: Structure, role in movement of molecules & macromolecules, comparison with gap junctions.

Plant Vacuole: Tonoplast membrane; ATPases, transporters as storage organelle.

Unit- II:

Chloroplast: Structure, genome organization, gene expression, RNA editing, nucleochloroplastic interaction.

Mitochondria: Structure, genome organization, Biogenesis.

Other cellular organelles: Structure & functions of microbodies, golgi apparatus, Lysosomes, endoplasmic reticulum.

Nucleus: Structure, nuclear pores, nucleosome organization, DNA structure, A, B & Z forms, replication, damage & repair.

Transcription: Plant promoters & transcription factors, splicing, m-RNA transport, Nucleolus, t-RNA, micro-RNA.

Unit- III:

Cell shape & Motility: The cytoskeleton, organization & role of microtubules and microfilaments, motor movements, implications in flagellar & other movements.

Cell cycle and apoptosis: Control mechanisms, role of cyclins & cyclin dependent kinases, (retinoblastoma & E2F proteins), cytokinesis & cell plate formation, mechanism of programmed cell death.

Semester- I

Credit-6

F.M: 100

PAPER-IV

PLANT BIOCHEMISTRY

Unit- I:

Principles of Biophysical Chemistry: Reaction kinetics; equilibrium and law of mass action, concept of reaction rates, Thermodynamics: Concept and Laws of thermodynamics, biological applications.

Fundamentals of Biochemistry: Proteolysis of water and hydrogen ion concentration, pH, Buffers, Solution and Colligative properties; Stabilizing interactions: Vanderwaals, Electrostatic, Hydrogen bonding and Hydrophobic interactions; Metabolism and bioenergetics: Generation and utilization of ATP, coupled reaction, group transfer, biological energy transducers.

Unit- II:

Carbohydrate: Structure, Physical & Chemical properties, Biological activity of monosaccharide, oligosaccharide and polysaccharide.

Proteins: Amino acid classification, structure and properties, Proteins: Primary, Secondary, tertiary and quaternary structure, determination of amino acid sequence, Protein folding.

Lipids: Classification, Structure, Physical and Chemical properties of essential non essential fatty acids, Triglycerides, Phospholipids, Wax.

Secondary Metabolites: Importance of secondary metabolites, biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

Unit- III:

Enzymes: Nomenclature and Classification of enzymes, Enzymes kinetics: Michaelis- Menten equation and Briggs- Haldane modification; Determination of K_m , Competitive, non competitive and un-competitive inhibition of enzymes, Determination of inhibition constant. Mechanism of action of Chymotrypsin and Ribonuclease, Regulation of enzyme activity (covalent modification, feedback regulation and allosteric control)

Semester- I

Credit-6

F.M: 100

PAPER-V

PRACTICALS PERTAINING TO THEORY PAPERS

Reference Books

Semester-I to IV (Diversity of Plants-I, Diversity of Plants-II, Cell & Molecular Biology of Plant, Plant Physiology & Biochemistry)

- Smith, G. M., Crptogamic Botany Vol-I Algae and Fungi, McGraw Hill Publication.
- Smith, G. M., Crptogamic Botany Vol-II Bryophytes and Pteridophytes, McGraw Hill Publication.
- Kumar, H. D. (1988), Introductory Phycology, East-West Press, New Delhi.
- Maloy, S. r. Cronan, J. e. Jr. and Freifielder, D. (2008), Microbial Genetics, 2nd Edition, Norosa, New Delhi.
- Mehotra, R. S. and Aneja, R. S. (1988), An Introduction to Mycology, New Age International, New Delhi.
- Prescott, L. M. Harley, J. P. and Klen, D. A. (1999), Microbiology, 4th Edition, WCB- McGraw Hill, New Delhi.
- Alexopoulos, C. J. Mims, C. W. and Blackwel, M. (1996), Introductory Mycology, John Wiley, New York.
- Pandey, D. C., A Text Book on Algae (simple Photosynthetic Plants)
- Vashista, B. R. (1995), Botany for Degree Students, Vol-I & II Chand & Co. New Delhi.
- Sharma, O. P. (1990), Text Book of Algae, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
- Mehrotra, R. S. Plant Pathology- Tata McGraw Hill Publishing Co. New Delhi.
- Rangaswami, G & A. Mahadevan (1994), Diseases of Crop Plants in India (4th Ed.) Prentice Hall of India (P) Ltd., New Delhi, 1998.
- Vashishtha Series for Algae, Fungi Bryophyta Pteridophyta and Gymnosperms, S. Chand Publication.

- Sharma, O. P. Text Book of Fungi- Tata McGraw Hill Publishing Co., New Delhi.
- Srivastava, J. P. Introduction to Fungi, Central Book Dept. Allahabad, India.
- Dubey, H. C. (1990), An Introduction of Fungi, 2nd edition, Vikas Publishers, ISBN PB: 9788125914334.
- Parihar, N. S. (1991), Bryophyta, Central Book Dept. Allahabad.
- Parihar, N. S. (1991), Biology and Morphology of Pteridophytes, Central Book Dept. Allahabad.
- Bhatnagar, S. P. and Moitra, A. (1996), gymnosperms, New Age International, New Delhi.
- Maloy, S. R. Cronan, J. e. Jr. and Freifelder, D. (2008), Microbial Genetics, 2nd Edition, Narosa, New Delhi.
- Chamberlin, C. J. (1935), Gymnosperms: Structure and Evolution, Dover Publications, New York.
- Cooper, G. M. (1997), The Cell: A molecular approach, ASM Press, Washington, D. C., USA.
- Buchachnan, B. B. Grissem, W and Jones, R. L. J. (2000), Biochemistry and molecular biology of plants, American Society of Plant Physiologists, Rockville, USA.
- Malacinski, G. M. and Feidfelder, D. (1998), Essentials of Molecular Biology, 3rd Edition, Jones and Bartel, London.
- Lewine, B. (2004), Gene VIII, Person- Prentice Hall, London.
- Devlin, R. N. and Witham, F. H. (1983), Plant Physiology, CBS Publishers, Delhi.
- Salisbury, F. B. and Ross, C. W. (1992), Plant Physiology, 4th Edition, Wadsworth Publication, California, USA.
- Noggle, G. R. and Fritz, G. J. (1983), Introductory Plant Physiology, 2nd ed. 2010.
- Boyer, R. (2004), Modern Experimental Biochemistry, 3rd Edition, Pearson Educational Publication, Singapore.
- Taiz, L. and E. Zeiger, 2002, Plant Physiology, 3rd Edition, Sinauer Associates, Inc. Sunderland, M. A. 690 pp.
- David Freifelder (1995), Molecular Cell Biology- 2nd Edition, Narosa Publishing House.

- Karp, G. Cell and Molecular Biology: Concepts and Experiments, 2000 John Wiley and Sons, New York.
- Benjamin Lweil, Genes VIII, 2004, Pearson Prentice Hall, New Jersey.
- Harvey, Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, S. Lawrence Zipursky, James Darnell, 2004, Molecular Cell Biology, Fifth Edition, W. H. Freeman and Company, New York.
- Sawhney, R. Singh: Introductory Practical Biochemistry, Narosa Publishing House, Pvt. Ltd.
- Rangaswamy, D. (1988), Disease of crop plants in India, Prentice Hall India, Ltd. New Delhi.
- Asada, Y. Bbushnell, N. R. Ouchi, S. and Vance, P. (1982), Plant Infection, The Physiology and Biochemical basis, Springer Verlag, Berlin, New York.
- Kosuge, T and Nester, EN (1984), Plant Microbe Interaction- Molecular and Genetic Perspectives, MacMillan, New York.

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Semester- II

Credit-6

F.M: 20+80=100

PAPER-VI

CYTOGENETICS, PLANT BREEDING

Unit- I

Chromatin Organization: Chromosome structure and Models, nucleolus, Euchromatin and heterochromatin, Chromosome banding, telocentric chromosome, isochromosome and B chromosome, Cell cycle, Molecular basis of cell division, Initiation of Meiosis Karyotype and its significance.

Genetic recombination and mapping: Critical appreciation of Mendel's Law, Gene interactions, Linkage and crossing over, two and three point cross, Coincidence coefficient and interference, Molecular basis of recombination, Role of Rec A and Rec BCD, Physical mapping of genes on chromosomes, Sex determination in plants.

Unit- II:

Structural and Numerical alternation in Chromosomes: Spontaneous and induced mutations, Physical and Chemical mutagens, Chromosomal aberrations, Meiotic behaviour of deletion, duplication, inversion and translocation, Molecular basis of gene mutation, DNA damage and repair mechanisms, Euploids and aneuploids- classification, origin, induction, cytological features and genetic analysis, Role of polyploidy in evolution and practical significance in crop improvement.

Plant Breeding: Method of plant breeding- introduction & selection (Pedigree, back cross, mass selection, bulk method), male sterility and heterosis breeding, mutation breeding.

Unit- III:

Genetics of Prokaryotes and Eukaryotic Organelles: Genetic transformation, transduction and conjugation in bacteria, Gene mapping in bacteria, Genetic recombination in bacteriophages and mapping of phage genome, Genetics of mitochondria and chloroplasts, Cytoplasmic male sterility, Transposable genetic elements.

Semester- II

Credit-6

F.M: 20+80=100

PAPER-VII BIOTECHNOLOGY

Unit- I:

Plant Cell, Tissue & Organ Culture: History, scope and concept of cellular differentiations, totipotency, fundamental aspects of morphogenesis: organogenesis and somatic embryogenesis, Clonal propagation, Artificial seeds, Hybrids through embryo rescue. Androgenesis and production of haploids, Callus and cell suspension culture, Production of somaclonal variants, production of secondary metabolites in cultures, Cryopreservation.

Unit- II:

Somatic Hybridization and Cybridization: Factors affecting protoplast isolation, culture and plant regeneration, Protoplast fusion- chemical fusion & electrofusion mechanism & techniques, Selection of heterokaryotic fusion products, biochemical selection and physical selection (micromanipulation, flow cytometric characterisation and cell sorting), Analysis of hybrids, Somatic hybrids and cybrids for crop improvement.

Unit- III:

Recombinant DNA Technology: Gene cloning- principles, Cloning vectors- plasmids, phages, cosmids & phagemids; Artificial chromosomes, Polymerase Chain Reaction- principles, types and applications, RT-PCR, Genomic and c DNA libraries; Construction of recombinant DNA molecules and their mobilization into bacteria; Analysis of recombinant clones, DNA sequencing.

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Semester- II

Credit-6

F.M: 20+80=100

PAPER-VIII

PLANT PHYSIOLOGY

Unit- I:

Membrane transport and translocation of water and solutes: Uptake, transport and translocation of water, ion, solutes and macromolecules by membrane transport through xylem and phloem; transpiration and stomatal movement, mechanism of loading and unloading of photoassimilates.

Unit- II:

Photosynthesis: Photosynthetic pigments and light harvesting complexes, mechanism of electron transport, photoprotective mechanisms; CO₂ fixation, C₃, C₄ and CAM pathways, Photorespiration.

Respiration and Lipid Metabolism: Glycolysis, TCA cycle, electron transport and ATP synthesis, alternate oxidase system, structure and functions of lipids, fatty acid biosynthesis, structure and function of carbohydrates.

Unit- III:

Nitrogen Metabolism: Biological nitrogen fixation, mechanism of nitrate uptake and reduction, nitrate and ammonium assimilation, amino acid biosynthesis.

Stress Physiology: Responses of plants to biotic (pathogen and insects) and abiotic (water temperature and salt) stresses. Metal toxicity, oxidative stress.

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Semester- II

Credit-6

F.M: 20+80=100

PAPER-IX

PLANT TAXONOMY, ECOLOGY

Unit- I:

Nomenclature: The species concept, delimitation of taxa and attribution of ranks, salient features of ICBN, relevance of taxonomy to conservation, sustainable use of bioresources, herbarium and floras, herbarium methodology, important herbaria of the world. Phenetic and phylogenetic systems of classification, relative merits and demerits of major system of classification, cladistics in taxonomy, Relevance of taxonomy to conservation, Molecular taxonomy.

Taxonomic evidence: Morphology, palynology, anatomy, embryology, cytology and Phytochemistry, Range of floral structures: Ranales, Rosales, Asterales, Scitaminae and Orchidales.

Unit- II:

Physical and biotic environment, Biotic and abiotic interactions, concept of habitat and niche, niche width and overlap, fundamentals and realised niche, resource partitioning and character displacement, Population characteristic, population growth curves, population regulation, life history strategies (r and k selections), concept of metapopulation- Demes, Dispersal, Interdemic extinctions, age structure populations, Species interactions: types and interspecific competition, herbivory, carnivory, pollination and symbiosis.

Unit- III:

Community Ecology: Nature, Structure and its attributes, levels of species diversity and its measurement. **Edges and Ecotones, Ecological succession:** Types, mechanism, changes involved in succession, climax concept. **Ecosystem Ecology:** Structure, function, energy flow, mineral cycling (C, N, P), Primary Production and decomposition, structure and functions of Indian ecosystems: Terrestrial (forest and grassland) and aquatic (fresh water, marine and estuarine).

Semester- II

Credit-6

F.M: 100

PAPER-X

PRACTICALS PERTAINING TO THEORY PAPERS

Semester-VI to IX (Cytogenetics, Plant Breeding, Biotechnology, Plant Physiology, Plant Taxonomy, Ecology)

Reference Books

- Glick, B. R. and Pasternak (2003), Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press, Washington, D. C. USA.
- Kye, L and Kleyn, J. (1996), Plants From Test Tube to: An Introduction to Micropropagation, 3rd Edition, Timber Press, Portland, USA.
- Pollard, W. J. and Walker (1990), Plant Cell and Tissue Culture, Vol-VI, Humana Press, Clifton, USA.
- Subramanyam, N. S. (1995), Modern Plant Taxonomy, 1st Edition, Vikas Publication House, Pvt. Ltd., Publisher.
- Sharma, O. P. (2009), Plant Taxonomy, 2nd Edition, Tata McGraw Hill Publisher.
- Sambamurty, A. V. S. S. (2005), Taxonomy of Angiosperms, I. K. International Pvt. Ltd. New Delhi.
- Mitra, J. N. (1964), An Introduction to systematic, Oxford & IBH Publishers, New Delhi, Calcutta- 823 pp.
- Lawrence, G. H. (1951), Taxonomy of Vascular Plants, 1st Edition, Prentice Hall College, Div Publishers, ISBN-13, 978-0023681905, 823 pp.
- Sharma, P. D. (1991), Ecology and Environment, 10th Edition, 2005, Rastogi Publication, ISBN, 8171339050, 9788171339051, 640 pp.
- M. C. Dash, (2004), Fundamentals of Ecology, 4th Edition, McGraw Hill Education Publishers, 504 pp.
- Gomez, K. A. and Gomez, A. A. (1984), Statistical Procedures for Agricultural Research, 2nd Edition, John Wiley, New York.

- Kormondy, E. J. (1996), Concepts of Ecology, Prentice Hall of India, New Delhi.
- Odum, E. P. (1971), Fundamentals of Ecology, Saunders, Philadelphia, USA.
- Misra, B. N. and Misra, M. K. (1998), Introductory Practical Biostatistics, Naya Prokash, Kolkata.
- Smith, R. L. (1996), Ecology and Field Biology, Harper Collins, New York.
- Subrahmanyam, N. S. and Sambamurty, A. V. S. S. (2000), Ecology, Narosa, New Delhi.
- Kothari, A. (1997), Understanding Biodiversity: Life sustainability and Equity. Orient Longman, New York.
- Negi, S. S. (1993), Biodiversity and its Conservation in India, Indus Publishing Company, New Delhi.
- Simmonds, N. W. (1979), Evolution of Crop Plants, Longman, New York.
- Bewley, J. D. and Black, M. (1994), Seed: Physiology of Development and Germination. Plenum, New York.
- Bhojwani, S. S. and Bhatnagar, S. P. (2008), The Embryology of Angiosperms, Vikas Publishing House, New Delhi.
- Raghavan, V. (1997), Molecular Embryology of Flowering Plant, Cambridge University Press, Cambridge.
- Raghavan, V. (1999), Development Biology of Flowering Plants, Springer-Verlag, New York.
- K. Wilson and Walker J. Practical Biochemistry- Principles and Techniques, 5th Edition, Tata McGraw Hill Publishers.
- P. Maheshwari (1950), Introduction to the Embryology and Angiosperms, McGraw Hill, New York.

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SECOND YEAR

Semester- III

Credit-6

F.M: 20+80=100

PAPER-XI

PLANT DEVELOPMENT AND REPRODUCTION

Unit- I:

Differentiation and Development: Difference between animal and plant cell development with unique features in plant cell development, use of mutants in seedling development; Molecular analysis of shoot apical meristem, root apical meristem & leaf growth, leaf development and phyllotaxy, transition to flowering, vascular tissue differentiation of root, shoot & leaf, Floral development & homoeotic mutants in Arabidopsis & Antirrhinum.

Unit- II:

Developmental Biology: Molecular and cytological analysis of endosperm & fruit development, fruit ripening and its manipulation; polyembryony, apomixes, seed germination, seed dormancy, bud dormancy, types & programmed cell death in life cycle of plants, metabolic changes associated with senescence and its regulation. Influence of hormones & environmental factors on senescence.

Unit- III:

Male Gametophyte: Structure of anthers, microsporogenesis, role of tapetum, pollen development, male sterility, male nuclei dimorphism and hybrid seed production, pollen germination, pollen tube growth and guidance, pollen storage, pollen allergy, pollen embryos.

Female Gametophyte: Ovule development, megasporogenesis, organization of the embryo sac, structure of the embryo sac cells, floral characteristics, pollination mechanisms and vectors, breeding systems, structure of pistil. **Developmental**

Embryology: Pollen-stigma interactions, sporophytic and gametophytic self incompatibility (cytological, biochemical and molecular aspects), double fertilization in vitro fertilization.

Semester- III

Credit-6

F.M: 20+80=100

PAPER-XII

CONSERVATION BIOLOGY

Unit- I:

Concepts and concerns of biodiversity, biodiversity status, monitoring and documentation, major drivers of biodiversity changes, plant introduction, Invasion and its impact on biodiversity, biodiversity mapping.

Unit- II:

Resource Conservation: Survey and regeneration of bioresources, endemism and hot spots, endangered plants, red data book, convention of biological diversity. Principles of conservation, extinction, environmental status of plants based on IUCN, Salient features of Biodiversity Act and rules, Strategies for resources conservation and management strategies.

Unit- III:

In situ Conservation: International efforts and Indian initiatives; protected areas in India- Sanctuaries, National Parks, Biosphere reserves, Wetlands and mangroves for conservation of wild biodiversity.

Ex situ Conservation: Principles and practices; botanical gardens, field gene banks, seed banks, cryobanks, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), ICAR, CSIR, DBT and ICRISAT.

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Semester- III

Credit-6

F.M: 20+80=100

PAPER-XIII

PLANT PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY

Unit- I:

Sensory Photobiology: Pigments as photoreceptors, structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins, photoperiodism.

Flowering and Senescence: Mechanism of flowering, Vernalization, biological clocks. Molecular mechanism of senescence and aging in plants.

Unit- II:

Plant Growth Regulators: Biosynthesis, storage, breakdown and transport of plant hormones; Mechanism of action, physiological effects and applications of plant growth regulators. Growth movement, measurement and indices.

Unit- III:

Male Gametophyte: Structure of anthers, microsporogenesis, role of tapetum, pollen development, male sterility, male nuclei dimorphism and hybrid seed production, pollen germination, pollen tube growth and guidance, pollen storage, pollen allergy, pollen embryos.

Female Gametophyte: Ovule development, megasporogenesis, organization of the embryo sac, structure of the embryo sac cells, floral characteristics, pollination mechanisms and vectors, breeding systems, structure of pistil.

Developmental Embryology: Pollen-stigma interactions, sporophytic and gametophytic self incompatibility (cytological, biochemical and molecular aspects), double fertilization, in vitro fertilization.

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Semester- III

Credit-6

F.M: 20+80=100

PAPER-XIV

PLANTS AND ENVIRONMENT

Unit- I:

Environment and the Plants: Concept of environment and its components, atmosphere, Hydrosphere, lithosphere and biosphere, physical and chemical environment.

Biogeography: Major terrestrial Biomes (Vegetation types of the World and India), theory of Iceland Biogeography, Biogeographical zones of India.

Unit- II:

Plants for Environmental Protection: Salt tolerant plant (Mangroves) and their role for environmental protection, nature and characteristics of mangroves and their distribution in India (Sundarban and Bhitarkanika), deforestation and afforestation, social forestry, agroforestry, waste land and mine reclamation.

Phytoremediation and Phytomining: Concept and definition of phytoremediation and Phytomining, methods of phytoremediation: Phytoextraction, rhizofiltration, phytodetoxification, phytovolatilization, role of hyperaccumulators, biomining and bioleaching.

Unit- III:

Environmental Pollution: Environmental pollution (water, air and soil)- their effects and control measures, global environmental changes (Green house effects and global climatic changes).

Plants and pollution control: Bioindicators of water and air pollution: Algae and lichens as indicator plants, role of lichens on phytoair monitoring, insecticidal plants, plants as natural pesticides.

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Semester- III

Credit-6

F.M: 100

PAPER-XV ADVANCED PRACTICALS

1. T. S./ L. S. of Anther, Ovary and Ovule of angiosperms.
2. Observation of permanent slides related to embryology.
3. Microtome of RAM and SAM, material fixation, block preparation, section cutting and staining.
4. In-vitro germination of pollen grains.
5. DNA isolation and purification, quality check in spectrophotometer and gel electrophoresis.
6. PCR analysis.
7. Tissue culture techniques, media preparation, different stages.
8. Karyotype analysis, chromosomal anomaly, comet assay.
9. Microbial culture, Gram staining, endospore staining, Micorrhiza fungi staining.
10. Antimicrobial assay.
11. Isolation, purification and algal culture.
12. Quantitative analysis of protein, carbohydrate, chlorophyll, proline, sugar etc.
13. Phytochemical isolation, qualitative and quantitative analysis of phytochemicals by Spectrophotometer/TLC/HPLC etc.
14. Protoplast isolation and fusion.
15. Synthetic seed preparation/ immobilization technique.

Semester-III (Plant Development, Reproduction and Economic Botany, Conservation Biology, Plant Physiology and Developmental Biology, Plants and Environment/ Environmental Studies)

References

1. Krishnamurthy, K. V. 2004, An Advanced textbook on Biodiversity Principles and Practice, Oxford and IBH Publishing Co. Pvt. Ltd.

2. Das, R. C, Baral, J. K., Sahu, N. C. and Misra, M. K. (1998), The Environmental Divide: The Dilemma of Developing Countries, A. P. H. Publication, New Delhi.
3. Heywood, V. H. and Watson, R. T. (1995), Global Biodiversity Assessment, Cambridge University Press, UK.
4. Hill, M. K. (1997), Understanding Environmental Pollution, Cambridge University Press, UK.
5. Mason, C. F. (1991), Biology of Freshwater Pollution, Longman, New York.
6. K. V. Krishnamurthy- An Advanced Textbook on Biodiversity Principles and Practice, Oxford & IBH Publishing Co. Pvt. Ltd.
7. Gomez, K. A. and Gomez, A. A. (1984), Statistical Procedures for Agricultural Research, 2nd Edition, John Weley, New York.
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Semester- IV

Credit-6

F.M: 20+80=100

PAPER-XVI

ENVIRONMENTAL BIOTECHNOLOGY-I

Unit- I:

Atmospheric Chemistry and Air Pollution: Composition of air, major regions of atmosphere, photochemical reactions, photochemical smog, sources and types of air pollutants, acid rain, ozone depletion, green house gases.

Air Pollution and its Control: Sampling and analysis of air pollution from ambient air and point sources, technological methods of air pollution control, particulate emission control, gas emission control, role of plants in air pollution control.

Unit- II:

Soil Pollution and Control: Soil structure and soil profile, Physico-chemical properties, soil conservation, soil pollution and its control, soil remediation and disposal.

Solid waste processing technology: Solid wastes sources and composition, classification, aerobic and anaerobic composting, reactor and non-reactor composting, biogas generation, vermiculture, solid waste reuse, management of urban and industrial solid waste.

Unit- III:

Water Pollution and Control: Surface water resources, surface water degradation, eutrophication, waste water collection and treatment, physical, chemical and biological processes, measurement of water pollution, anaerobic sludge treatment.

Waste water treatment processes: Development of treatment processes, oxidation, nitrification, denitrification, secondary treatment plants, waste water recycling, recycling, algae-fish and duck weed system, waste water as resources, batch reactor.

Semester- IV

Credit-6

F.M: 20+80=100

PAPER-XVII

ENVIRONMENTAL BIOTECHNOLOGY-II

Unit- I:

Biodegradation of organic pollutants: Degradation of industrial pollutants, measurement of biodegradability, aerobic and anaerobic degradation, degradation of pesticides, hydrocarbon removal, molecular basis of pesticide removal, Bioaccumulation.

Unit- II:

Bioremediation of Metal: Biomining and bioleaching, biosorption, phytochelation, phytoextraction, rhizofiltration, phytovolatilization, roles of metalophores, phytoremediation of organics, biotransformation of toxic metal pollution.

Unit- III:

Energy Management: Biomass, bio energy and biofuels, energy plantation, petroplants, hydrocarbon from higher plants, methane, bioethanol and biohydrogen generation.

Biodiversity Monitoring and Management: Concept and definition, quantification, in situ and ex situ conservation measures, Biosphere reserve, biodiversity conventions and legislation (Rule). Biotechnology for biodiversity conservation. Forest resources, types and management.

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Semester- IV

Credit-6

F.M: 20+80=100

PAPER-XVIII

ECONOMIC BOTANY, BIOSTATISTICS, EVOLUTION

Unit- I:

Economic Botany: Origin and domestication of cultivated plants, World Centres of diversity of domesticated plants, plant introduction and secondary centre origin, evolution of uses of food, forage, fodder, fibre and oil-yielding crops. Use of medicinal and aromatic plants, Important firewood and timber yielding plants and non-wood forest products, plants used as avenue trees for shade, pollution control and aesthetics.

Unit- II:

Biostatistics: Statistical Methods: Sampling method, sampling distribution, parametric and non-parametric statistics, measures of central tendency and dispersion, mean, mode and median, Mean deviations, coefficient of variance (CV). Standard deviations, standard error of mean (SEM), probability distribution (normal, binomials & poisson), tests of significance (t-test and X^2 test), analysis of variance.

Unit- III:

Evolution: Lamarck and Darwin concept of variation, adaptation and natural selection, evolution of prokaryotes, origin and evolution of eukaryotes, anaerobic and aerobic metabolism, origin and development of major group of organism in geological time scale, molecular evolution.

Population Genetics: Population, Genepool, Gene frequency, Harrydy- Weinberg Law, Adaptive radiation, Isolating mechanism, Speciation, Allopatricity and Sympatricity, Convergent evolution, Sexual selection, Coevolution.

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Semester- IV

Credit-6

F.M: 100

PAPER-XIX

PRACTICAL

Practicals pertaining to Theory paper-XVIII

Semester- IV

Credit-6

F.M: 50+50=100

PAPER-XX

DISSERTATION PROJECT

Topic Include

Biochemistry and Molecular Biology, Biotechnology and Plant Genetic Manipulations, Cytogenetics and Cell Biology, Environmental Biotechnology, Microbial Technology, Biosystematics.

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