

KHALLIKOTE AUTONOMOUS COLLEGE , BRAHMAPUR
M.Sc . BOTANY (Semester System-CBCS)
Total Marks =2000 Total Credits= 80 2019-2020

Sl No.	Semester/Paper code.	Title of the paper	Total Marks TE+IA	No. of Credits
FIRST SEMESTER 20 CREDITS (500 MARKS)				
1	CC-101	Cell Biology	80+20	04
2	CC-102	Molecular Biology	80+20	04
3	CC-103	Cytogenetics	80+20	04
4	CC-104	Gene and Genomics	80+20	04
5	CC-105-P	Practical (CC-101 to CC-104)	100	04
SECOND SEMESTER 20 CREDITS (500 MARKS)				
6	CC-201	Biology and Diversity of Lower Plants-I	80+20	04
7	CC-202	Biology and Diversity of Lower Plants-II	80+20	04
8	CC-203	Plant Ecology	80+20	04
9	CC-204	Plant Resource Utilization and Conservation	80+20	04
10	CC-205-P	Practical (CC-201 to CC-204)	100	04
THIRD SEMESTER 20 CREDITS (500 MARKS)				
11	CC-301	Biology and Diversity of Gymnosperms and Taxonomy	80+20	04
12	CC-302	Development and Reproduction in Angiosperms	80+20	04
13	CC-303	Plant Stress Physiology and Signaling	80+20	04
14	CC-304	Research Methodology	80+20	04
15	CC-305-P	Practical (CC-301 to CC-303)	100	04
FOURTH SEMESTER 20 CREDITS (500 MARKS)				
16	CC-401	Plant Biochemistry and Metabolism	80+20	04
17	CC-402	Biostatistics and Instrumentation	80+20	04
18	CC-403	Plant Tissue Culture and Biotechnology	80+20	04
19	CC-404-PROJECT	Project related to Biotechnology	100	04
20	CC-405-P	Practical (CC-401 to CC- 403)	100	04

In semester 1 and 3: Internal Exams will be written exams for 40 marks and home assignment for 40 marks. In Semester 2: home assignment and viva for (40 + 40) marks and Semester 4 : seminar presentation and viva for (30+30) marks.

M. SC. (BOTANY) FIRST SEMESTER

PAPER - CC-101 CELL BIOLOGY (04 credits) Marks: 100 (80+20)

Unit I - Cell organization and dynamics:

20 marks

Cell size, shape, structure. and function of cell wall, growth and biogenesis of cell wall. cytoskeleton: structure, organization and role of microtubules and microfilaments, implications in flagellar and other movements. Intracellular transport mechanisms.

Unit II – Cell structure and function of cytoplasmic organelles

20 Marks

Membrane structure model and function: lipid bilayer and membrane protein diffusion, osmosis, ion carriers, channels and pumps; receptors, electrical properties of membranes.

Structural organization and function of intracellular organelles: chloroplast, mitochondria, peroxisome, endoplasmic reticulum, ribosome, lysosome, vacuole and phagocytosis.

Unit III – Plant nucleus, nucleolus and chromosome

20 Marks

Nucleoplasm, nuclear membrane, nuclear pore, chromatin and chromosome, heterochromatin and euchromatin, special types of chromosomes: salivary gland chromosomes, lamp brush chromosome, B-chromosomes, autosomes and sex chromosomes in plants, chromosome morphology and number, karyotype, chromosome banding and painting, packing of DNA in eukaryotic chromosome, Nucleosome.

Unit IV – Plant genome variation, DNA constancy and variation

20 Marks

Plant genome variations, Genomic DNA, DNA constancy (C), Comparison of C-values across plant kingdom, C-value paradox, DNA-melting: denaturation and renaturation kinetics, satellite DNA, cot-curve, unique and repetitive DNA.

Select books for reading :

Buchachnan, B. B., Grisse, W. and Jones, R. L. J., (2000). Biochemistry and molecular biology of plants. American Society of plant physiologists, Rockville, USA

Cooper G. M. (1997). The Cell: A molecular approach. ASM Press, Washington, D. C., USA.

Lewine, B. (2004) Gene VIII, Person-Prentice Hall, London.

Bolover, S. R. et al. (2004) Cell Biology : A short course, John Wiley and Sons, New Jersey, USA

PAPER - CC-102 MOLECULAR BIOLOGY (04 credits)

100 marks (80+20)

Unit I - Cell cycle and cell division :

20 Marks

Cell cycle: mitosis, meiosis, DNA synthesis in cell cycle, regulation of cell cycle: role of cyclins and cyclin-dependent kinases; cytokinesis and cell plate formation, programmed cell death and differentiation in plants.

Unit II - DNA structure, replication:

20 Marks

DNA structure (A, B and Z types), prokaryotic, organelle and DNA replication: replicon, enzymes involved, replication origin and replication fork, fidelity of replication, inhibitors of replication. replisome, primosome, telomerase.

Unit III - RNA structure and transcription

20 Marks

Prokaryotic and eukaryotic RNA transcription, RNA types: mRNA, tRNA, rRNA, siRNA, miRNA, RNAi, RNA polymerases, capping, elongation, and termination, transcription factors, RNA-processing, , transcription factors, RNA editing, splicing, and polyadenylation, spliceosome, RNA editing, RNA transport.

Unit IV- Protein synthesis and regulation

20 Marks

Genetic code, protein translation, transcription and translation, post-translational modifications, protein sorting and targeting, Control of gene expression at transcription and translation level, role of chromatin in gene expression and gene silencing.

Select books for reading :

Malacinski, G. M and Feidfelder, D (1998). Essentials of Molecular Biology, 3rd Ed. Jones and Bartel, London.

Lewine, B. (2004) Gene VIII, Person-Prentice Hall, London.

Pierce, B. A. (2006). Genetics: A Conceptual Approach. W. H. Freeman, New York.

PAPER - CC-103 CYTOGENETICS (04 credits)**Marks: 100(80+20)****Unit I - Classical genetics****20 Marks**

Mendelism and deviation of Mendelian ratios, epistasis, , Concept of gene : Allele, multiple alleles, pseudoallele, complementation tests, linkage and crossing over in eukaryotes, sex-linked inheritance, three point test cross and chromosome mapping ,extra chromosomal inheritance, sex determination in plants.

Unit II - Structural chromosomal aberrations :**20 Marks**

Chromosome aberration: deletion, duplication, inversion and translocation, chromosome breakage-fusion bridge cycle, Robertsonian translocations; B-A translocations; genetic consequences of chromosome aberrations, detection of chromosome aberrations

Unit III - Numerical chromosomal aberrations:**20 Marks**

Origin, induction and detection of numerical chromosome aberrations: basic and genetic chromosome number, aneuploidic agents, colchicines, euploidy, monoploidy, polyploidy, aneuploidy, haploidy, autopolyploidy and allopolyploidy, segmental allopolyploidy. Alien gene transfer through chromosome manipulation: Hybrid Vigor and heterosis.

Unit IV - Gene mutation, DNA damage and repair:**20 Marks**

Spontaneous and induced mutations, somatic and germinal mutation, transition, transversion, frame shift mutations, mechanisms of mutation induction, physical and chemical mutagens, molecular basis of mutations, Environmental mutagenesis and genetic toxicology. , Types of DNA damage and repair, non-homologous end-joining (NHEJ) and homologous recombination (HR) repair.

Select books for reading :

Lewine, B. (2004) Gene VIII, Person-Prentice Hall, London.

Pierce, B. A. (2006). Genetics: A Conceptual Approach. W. H. Freeman, New York.

PAPER - CC-104 GENE AND GENOMICS (04 credits)**Marks: 100(80+20)****Unit I - Genetics of prokaryotes and fine structure of gene:****20Marks**

Bacterial genetics: genetic exchange in bacteria: transformation, conjugation, plasmid, and transduction, lysogeny, genetic recombination in bacteriophage; gene fine structure: muton, recon, cistron; cis-trans test, transposable elements in prokaryotes and eukaryotes, mutations induced by transposons.

Unit II - Gene cloning:**20 Marks**

Restriction enzymes and vectors: plasmid, Bacteriophage P1, cosmid, YAC, BAC, PAC. Cloning strategies, rDNA, reverse transcriptase, Searching genes on the basis of open read frames (ORFs), cDNA, PCR, RT-PCR,RACE, site directed mutagenesis, gene probing and targeting, shotgun approaches for genome sequencing, Genomic and c DNA libraries.

Unit III : Genome and genomics**20 Marks**

Genome, comparative genomics and transcriptomics, physical mapping of genes on chromosomes; Use of FISH for physical mapping of genes in genome analysis, genetic markers: sequence tagged

sites (STS); DNA markers: RFLPs, RAPD, AFLP, SSLPs, SNPs; correlation between genetic and physical mapping.

Unit-IV Techniques used in gene and genome analysis

20 Marks

Basic techniques: Polyacrylamide and agarose gel electrophoresis techniques, Southern, Northern, Dot Blotting techniques, DNA sequence methods: chain termination and chemical degradation methods.

Select books for reading :

Brown, T. A. (1999) Genomes, John Wiley and Sons (Asia), Singapore.

Brown, T. A. (2001). Gene Cloning and DNA Analysis. Blackwell Science, London.

Glick, B. R. and Pasternak, J. J. (2003). Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, Washington, D. C., USA.

PAPER CC- 105 PRACTICALS Marks : 100 Practical of Paper CC-101 to-104.

M.SC. (BOTANY) SECOND SEMESTER

PAPER CC-201 BIOLOGY AND DIVERSITY OF LOWER PLANTS: I (04 credits)

Marks: 100 (80+20)

Unit I – Bacteria and Virus:

20 Marks

General account Eubacteria: Ultrastructure; Nutrition and reproduction; Biology and economic importance; Cyanobacteria: Salient feature and biological importance; Viruses: Characteristics, ultrastructure, chemical nature, replication and transmission; economic importance; Phytoplasma: General characteristics and role in causing plant diseases.

Unit II – Phycology-I:

20 Marks

Algae in diversified habitats (terrestrial, freshwater and marine); thallus organization; Cell ultrastructure; Reproduction (Vegetative, Asexual and Sexual); Criteria for classification of algae; Pigments; Reserve food; Pyrenoid, Flagella.

Unit-III Phycology-II

20 marks

Salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta ; Algal blooms; Algal biofertilizers; Algae as food, feed and its uses in industry.

Unit IV– Mycology-I :

20 Marks

General characters of fungi; Substrate relationship in fungi; Cell ultrastructure; Unicellular and multicellular organisation; Cell wall composition; nutrition; Reproduction (Vegetative, Asexual and sexual); Heterothallism; Heterokaryosis: Parasexuality; Recent trends in classification agents.

Select text books for reading:

Kumar, H. D. (1988). Introductory Phycology. East-West Press, New Delhi.

Maloy, S. R., Cronan, J. E. Jr. and Freifelder, D. (2008). Microbial Genetics, 2nd Ed. Norosa, New Delhi.

Mehrotra, R. S. and Aneja, R. S. (1998). An Introduction to Mycology, New Age International, New Delhi.

Prescott, L. M., Harley, J. P. and Klen, D. A. (1999). Microbiology, 4th Ed. WCB- McGra-Hill, New Delhi.

Alexopoulos, C. J., Mims, C. W. and Blackwel, M. (1996). Introductory Mycology, John Wiley and Sons, New York

Paper CC-202 BIOLOGY AND DIVERSITY OF LOWER PLANTS: II (04 credits)

Marks : 100 (80+20)

Unit-I : Mycology-II

20 marks

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina; Fungi in industry, medicine and as food; Fungal disease in plants and humans; Mycorrhizae; Fungi as bio-control agent.

Unit II - Bryophyta :

20 Marks

General classification, morphology. structure, reproduction and life history; Distribution and general account of Marchantiales. Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales: Economic and ecological importance.

Unit III - Pteridophyta -I:

20 Marks

General classification: Morphology, anatomy and reproduction; Evolution of stele; Heterosporry and origin of seed habit.

Unit IV- Pteridophyta – II:

20 Marks

General account of fossil pteridophyta; Introduction to Psilopsida, Lycopsida, Sphenopsida and Pteropsida. General Classification, morphology, anatomy and reproduction of genera related to Psilopsida, Lycopsida, Sphenopsida and Pteropsida .

Select text books for reading:

Parihar, N. S. (1991). Bryophyta, Central Book Depot Allahabad.

Parihar, N. S. (1991). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

PAPER CC- 203 PLANT ECOLOGY (04 credits)

Marks : 100 (80+20)

Unit I - Ecosystem ecology:

20 Marks

Structure and functions; Primary Production: Methods of measurement. Controlling factors: Energy dynamics : trophic organization, energy flow pathways. Ecological efficiencies: mechanism of litter decomposition: Global biogeochemical cycling (C, N, P) and energy flow, primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

Unit II - Vegetation organization:**20 Marks**

Concepts of community and continuum; analytical and synthetic characters of a community; Community coefficients; inter specific associations; ordination; concept of habitat and niche, niche width and overlap; fundamental and realized niche; Vegetation development; Cyclic and non-cyclic temporal changes; floristic composition; Facilitation, tolerance and inhibition models. Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory. Ecological Succession: Types, mechanisms, concept of climax. Biogeography: major biomes and vegetations theory of island biogeography; bio geographical zones of India.

Unit III – Environmental pollution:**20 Marks**

Environment: Physical environment; biotic environment; biotic and abiotic interactions. Kinds, sources and quality parameters of air water and soil pollution; Effects of pollutants on plants and ecosystems; Climatic changes: Greenhouse gases; Ozone layer and ozone hole; Consequences of climatic change (CO₂ utilization, global warming, sea level rise, UV radiation)

Unit-IV : Conservation of Biodiversity:**20 marks**

Biological Diversity: Concept; IUCN categories of threat; Distribution and global patterns; Terrestrial biodiversity hot spots; Inventory; World centres of primary diversity of domesticated plants: The Indo-Burmese Plant Introductions and Secondary centres.

Select text books for reading:

Odum, E. P. (1971). Fundamentals of Ecology, Saundas, Philadelphia, USA.

Smith, R. L. (1996). Ecology and Field Biology. Harper Collins, New York.

Subrahmanyam, N. S., Sambamurty, A. V. S. S. (2000). Ecology. Narosa, New Delhi.

Paper CC-204 PLANT RESOURCE UTILIZATION AND CONSERVATION, Marks100 (80+20)**Unit I - Economic Botany :****20 Marks**

Origin, evolution, botany, cultivation and uses of important food, forage, fodder, fibre, vegetable, fruit.oil yielding and medicinal plants; Important fire wood and timber yielding plants like bamboos, rattans; Plants used for paper making, gums, tannins, dyes and resins; Plants used as avenue trees for shade, pollution control and aesthetics.

Unit II-Ecosystem Services:**20 Marks**

Concept of ecosystem services: Agroecosystems, Forest ecosystems and Marine ecosystems. Importance of ecosystem services for sustainable development, ecosystem assessment, ecosystem service cascade frame work, ecosystems service to enhance socio economic systems and biodiversity. Classification of ecosystems services: provisioning services, regulating services, cultural services. Enhancement ecosystem services: biomass, biodiversity, medicinal plants, eco-tourism.

Unit III - Principles of conservation :**20 Marks**

Extinctions; Environmental status of plants based on International Union for Conservation of Nature: *in situ* conservation: Concept; International efforts and Indian initiative: Protected areas in India: Sanctuaries. National Parks, Biosphere reserves, Wetlands. Mangroves, and Coral reefs

for conservation of wild biodiversity; *ex situ* conservation: Principles and practices; Botanical gardens.

Unit-IV: Conservation Strategies :

20 marks

Field gene banks: Seedbanks; *in vitro* repositories; Cryobanks; General account of the activities of Botanical Survey of India (BSI); National Bureau of Plant Genetic Resources(NBPGR); Indian Council of Agricultural Research(ICAR); Council of Scientific and Industrial Research(CSIR); Department of Biotechnology (DBT) for conservation, Non-formal conservation efforts.

Select text books for reading:

Wickens, G. E. (2001) Economic Botany: Principles and Practices, Springer Netherland

Kochar, S. L. (2016) Economic Botany: A Comprehensive Study, 5th Ed. Cambridge India, Delhi.

Smith, R. L. (1996). Ecology and Field Biology. Harper Collins, New York.

Heywood, V. H. and Watson, R. T. (1995). Global Biodiversity Assessment. Cambridge University Press, UK.

Hill, M. K. (1997). Understanding Environmental Pollution. Cambridge University Press, UK.

Mason, C. F. (1991). Biology of Freshwater Pollution. Longman, New York.

Grunewald, K, Bastian, O. (2015) Ecosystem Services – Concept, Methods and Case Studies

PAPER –CC- 205 PRACTICAL Marks : 100 Practical of Paper 201 to 204

M.SC. (BOTANY) THIRD SEMESTER

Paper-301 BIOLOGY AND DIVERSITY OF GYMNOSPERMS & TAXONOMY (04 credits)
Marks: 100(80+20)

Unit I - Gymnosperms I:

20 Marks

Classification of gymnosperms and their distribution in India; General account of Gymnosperm orders. Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae and Glossopteridaceae), Cycadeoideales, Cordaitales.

Unit II - Gymnosperms II :

20 Marks

Structure and reproduction in Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales.

Unit III - Taxonomy -I:

20 Marks

The species concept : Taxonomic hierarchy; species, genus, family and other categories; principles used in assessing relationship; delimitation of taxa and attribution of rank; Salient features of International Code of Botanical Nomenclature.

Unit-IV: Taxonomy-II :

20 Marks

Taxonomic evidence and tools: Anatomical, palynological, histological, cytological, phytochemical, molecular and genomic techniques as evidences and tools for solving taxonomic problems; phenetic vs phylogenetic system of classifications with special emphasis on Takhtajan and Cronquist systems of classification.

Select text books for reading:

Bhatnagar, S. P. and Moitra, A. (1996). Gymnosperms. New Age International, New Delhi.

Chamberlin, C. J. (1935). Gymnosperms: Structure and Evolution. Dover Publications, New York.

Davis, P. H. and Heywood, V. H. (1973). Principles of Angiosperms Taxonomy. Robert E. Kreiger, New York.

Heywood, V. H. and Moore, D. M. (1984). Current Concepts in Plant Taxonomy. Academic press, London.

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.

Takhtajan, A. L. (1997). Diversity and Classification of Flowering Plants. Columbia University Press, New York.

Paper-302 DEVELOPMENT AND REPRODUCTION IN ANGIOSPERMS (04 credits)

Marks: 100(80+20)

Unit I – Angiosperm Development-I:

20 Marks

Shoot development : Organization of the shoot apical meristem (SAM); Cytological and molecular analysis of SAM; Control of cell division and cell to cell communication; Control of tissue differentiation; Leaf growth and differentiation: Determination; phyllotaxy; control of leaf form; differentiation of epidermis and mesophyll; Root development: Organization of root apical meristem (RAM), cell fates and lineages; vascular tissue differentiation; lateral-roots; root hairs; root-microbe interactions.

Unit II – Reproduction in Angiosperm:

20 Marks

Microsporegenesis, Male gametophyte, Megasporegenesis, Female Gametophyte, Ovule development, Embryo Sac, Double Fertilization, Endosperm and embryo development, Flower development and genetics : Floral organ differentiation in *Arabidopsis*; Pollen development and gene expression; Male sterility; Sperm dimorphism; Organization of embryo sac; Pollination,

Unit III - Seed Dormancy and Phytohormones:

20 Marks

Dormancy :Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy; Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid.

Unit IV- Pollen –Pistil Interaction:

20 Marks

Pollen-pistil interaction; and Fertilization: Structure of pistil; Pollen-stigma interactions; Cytological, biochemical and molecular aspects of sporophytic and gametophytic incompatibility; Ultra-structure, nuclear cytology and cell lineage during embryo development.

Select text books for reading:

Buchachnan, B. B., Grissem, W. and Jones, R. L. J., (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Rockville, USA.

Taiz, L., Zeiger, E., Møller, I. M., Murphy, A (2014) Plant Physiology and Development, Sinauer Associates. Oxford University Press, New Delhi.

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). Developmental Biology of Flowering Plants. Springer-Verlag, New York.

Unit I – Water Relation and Physiology of Growth: 20 Marks

Mechanism of water absorption; Ascent of sap: Mechanism of water transport through xylem; Transpiration: Stomatal mechanism, Phloem loading and unloading; mechanism of transport of photosynthate.

Seed germination and seedling growth: Metabolism of nucleic acids and proteins and mobilization of food reserves during germination; hormonal control of seedling growth; gene expression; use of mutants in understanding seedling development

Unit-II Signal Transduction 20 marks

Signal transduction: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors; signal transduction pathways, second messengers, phospholipid signaling; role of cyclic nucleotides; calcium-calmodulin cascade; diversity in protein kinases and phosphatases; specific signaling mechanisms (two component sensory regulatory system in bacteria and plants; sucrose- sensing mechanism)

Unit-III Stress physiology 20 marks

Physiology of stress: Plant response to biotic and abiotic stress mechanism of biotic and abiotic stress tolerance; HR and SAR; water deficit and drought resistance; salinity stress; metal stress; freezing and heat stress; oxidative stress.

Unit- IV : Sensory Photobiology- 20 marks

History of discovery of phytochromes and cryptochromes and their photochemical and biochemical properties; photophysiology of light-induced responses; molecular mechanism of action of photo-morphogenic receptors, signaling and gene expression. Photoperiodism and its significance; endogenous clock and its regulation; floral induction and development: genetic and molecular analysis; role of vernalization: physiology of senescence: Types of senescence; metabolic changes associated with senescence and its regulation; influence of hormones and environmental factors on senescence

Select text books for reading:

Buchachnanan, B. B., Grisse, W. and Jones, R. L. J., (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Rockville, USA.

Devlin, R. N. and Witham, F. H. (1983). Plant Physiology. CBS Publishers, Delhi.

Salisbury, F. B. and Ross, C. W. (1991). Plant Physiology, Wordworth Publication California, USA.

Taiz, L., Zeiger, E., Møller, I. M., Murphy, A (2014) Plant Physiology and Development, Sinauer Associates. Oxford University Press, New Delhi.

Paper CC-304 RESEARCH METHODOLOGY (04 Credits)

Marks: 100 (80+20)

Unit-I Ecological Methods:

20 marks

Bomb Calorimetry, Determination of Energy Content of Plant Materials

General Methods for Physical and chemical Analysis of Soil.

Chlorophyll and Leaf area determination of Plant Communities

Dose Response and determination of threshold values: EC 50, EC100 and TLC.

Unit-II Microbial Methods

20 marks:

Preparation of Solid and Liquid Media for Algae, Fungi and bacteria, Mass Culture Techniques and application.

Data Analysis: ANOVA, Chi-square Test, Simple Correlation and Regression Analysis.

Unit-III Biochemical Methods:

20 marks

Purification and identification of biomolecules by Chromatography

Spectrometric analysis of Biomolecules : Plant pigments, Carbohydrates, proteins, Nucleic Acids and Enzymes.

Unit-IV Research paper writing and presentation:

20 marks

Structuring and writing a research paper (Review of literature, title, introduction, materials and methods, results and discussions and Citing References)

Choice of Journals and publishers in plant sciences, Journal Impact factor, Searching Literature.

Select text books for reading:

Ecology and Environment by P.D Sharma,

Fundamentals of Ecology by M.C. Dash and Satya Praksh Dash,

Fundamentals of Ecology by Eugene P. Odum, Gray W. Barret,

A text book of Plant Ecology by R.S Ambasht,

Biotechniques (Theory and Practical) by Prof. S.V. S Rana,

Research Methodlogy, Methods and Techniques by C.R. Kothari,

Practical Biochemistry by David T. Plummer,

Prescott's Micrology Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton

Brock Biology of Microorganisms (Pearsion International Edition) by Michael T. Madigan, Johan M. Martinco, Paul V. Danlap, David P. Clark.

Introductory Practical Biostatistics by B.N. Mishra & M. K. Mishra

Biostatistics by Sadguru Prasad

PAPER CC-305 PRACTICAL Marks : 100 Practical of Paper CC-301 to CC-304

M.SC. (BOTANY) FOURTH SEMESTER

Paper CC- 401 Plant Biochemistry and Metabolism 04 Credits

Marks : 100 (80+20)

Unit I –Basic biochemistry, bioenergetics and enzymology

20 Marks

pH, buffer, reaction kinetics and thermodynamics. Composition, structure, and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Nomenclature and classification of enzymes. Distribution of enzymes in plant, structure and function of Isoenzymes. kinetics of enzymatic catalysis; Michaelis -Menten equation and its significance; Lineweaver-Burk equation; Enzyme inhibition and kinetics; mechanism of enzyme action and its regulation. Factors affecting enzyme action.

Unit II – Photosynthesis and photorespiration:

20 Marks

Photosynthesis: light harvesting complex, structure and chemistry, Photolysis of water and Hill Reaction, Photo-phosphorylation, CO₂-fixation, C₃ and C₄ and CAM pathways, photorespiration and its significance.

Unit-III Respiration and oxidative metabolisms

20 marks

Glycolysis, Fermentation, TCA cycle, pentose phosphate path ways, mitochondrial electron transport and ATP synthesis, alternate oxidase, energy budget of respiration.

Oxidative metabolism: reactive oxygen species (ROS), antioxidants, antioxidant enzymes: catalase, peroxidases, superoxide dismutase, glutathione transferase, glutathione reductase, Halliwell–Asada cycle.

Unit IV - Lipid, sulphur, nitrogen and secondary metabolisms :

20 Marks

Structure and function of lipids; fatty acid biosynthesis; synthesis of membrane lipids ,structural lipids and storage lipids; catabolism of lipids, Sulphur metabolism: Sulfate uptake, transport and assimilation.

Nitrogen of metabolism: Types of Nitrogen fixation, Biological nitrogen fixation; nodule formation and nod factors; mechanism of nitrate uptake and reduction; ammonium uptake, Nitrogen fixation by cyanobacteria and other plants.

Secondary metabolites: Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

Select text books for reading:

Buchachnanan, B. B., Grisse, W. and Jones, R. L. J., (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Rockville, USA.

Goodwin, T. W. and Mercer, E. I. (1985). Introduction to Plant Biochemistry, 2nd ed. Pergamon, Oxford.

Mathews, C. K., Van Holde, K. E. and Ahern, K. G. (2000). Biochemistry, Addison-Wesley Publishing Company, San Francisco, USA.

Unit I - Biostatistics I :

20 Marks

General concepts; Frequency distribution : Bargraphs, histograms, polygons, curves; Central tendency: Mean, mode and median; Dispersion: Mean deviation, variance; standard deviation, Concept of probability: Addition and multiplicative theorems of probability; conditional probability; Theoretical distributions: Normal, Binomial and Poisson distribution.

Unit II - Biostatistics II :

20 Marks

Estimation : Types of estimation; confidence interval and level of confidence Hypothesis testing : Test of significance; standard error of mean; t-test: t distribution, student t-test and paired t-test; Chi square test: Chi square distribution and Chi square test for Goodness of fit; F -test: F -statistic and analysis of variance.

Unit III –Physical techniques I:

20 Marks

Centrifugation: Principles of centrifugation; normal, ultra, refrigerated, differential, density gradient methods of centrifugation;;
Chromatography: General principles; paper, thin layer, adsorption, ion exchange, affinity, gel filtration techniques; GLC and HPLC;
Electrophoresis :General principles; paper, starch gel, cellulose acetate, SDS polyacrylamide and agarose electrophoresis; isoelectric focusing; electroblotting; electroelution; gradient gel, 2-D and immuno electrophoresis.

Unit IV- Physical techniques -II :

20 marks

Microscopy; Electron microscopy, SEM and TEM, Confocal microscopy, Immuno techniques; autoradiography, *in situ* hybridization by radio and fluorescent labeling, FISH and GISH, Tunnel assay, Feulgen staining of chromosome, Cytophotometry, Flow cytometry, Comet Assay, Spectrophotometry : Beer-Lambert law; colorimetry; fluorometry, principle and applications,, Mass Spectroscopy, X-Ray Crystallography, FTIR (Fourier Transform Infra-red Spectroscopy).

Select text books for reading:

- Cooper, T. G. (1977) The Tools of Biochemistry, John Wiley and Sons, Singapore.
Wilson, K. and Walker, J (2010) Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, Delhi.
Gomez, K. A. and Gomez, A. A. ((1984). Statistical Procedures for Agricultural Research, 2nd Ed. John Weley and Sons, Singapore.

