

PONDICHERY UNIVERSITY
B.Sc. PLANT SCIENCE (MAIN AND ALLIED) – SEMESTER
SYSTEM

Details of papers and scheme of examination (Effective from the academic year 2010-11)

II B.Sc.		
THIRD SEMESTER		
Paper-V Anatomy of Angiosperms	3 Hrs	100
Paper-VI Development and Reproduction in Flowering Plants	3 Hrs	100
Practical-III (Covering Papers V & VI)	3 Hrs	40
FOURTH SEMESTER		
Paper-VII Diversity of Angiosperms and their Systematics	3 Hrs	100
Paper-VIII Cell Biology	3 Hrs	100
Practical-IV (Covering Papers VII & VIII)	3 Hrs	40
III B.Sc.		
FIFTH SEMESTER		
Paper-IX Plant Physiology	3 Hrs	100
Paper-X Plant Biochemistry and Biophysics	3 Hrs	100
Paper-XI Ecology and Utilization of Plants	3 Hrs	100
Paper-XII Genetics and Plant Breeding	3 Hrs	100
Paper-XIII Biostatistics and Computer Applications in Biology	3 Hrs	100
Practical-V (Covering Papers IX, X, XI, XII, XIII)	3 Hrs	70
SIXTH SEMESTER		
Paper-XIV Microbiology	3 Hrs	100
Paper-XV Molecular Biology	3 Hrs	100
Paper-XVI Plant Biotechnology	3 Hrs	100
Paper-XVII Medical Botany	3 Hrs	100
Paper-XVIII Group Project* OR Paper-XVIII Special paper (Optional) a. Marine Botany OR b. Biodiversity and Conservation	Project report 75 + Viva voce 25 3Hrs	100 100
Practical-VI (Covering Papers XIV, XV, XVI, XVII & XVIII). In case group project is opted Practical VI covers papers XIV, XV, XVI & XVII	3 Hrs	70

PAPER-V: ANATOMY OF ANGIOSPERMS

Course Objectives:

- To understand internal structures of the plant parts
- To understand techniques and aids required for the studying plant parts

Unit-I

Cell Wall, Structure and function. Classification of tissues, simple tissues- parenchyma, Collenchyma and Sclerenchyma. Complex tissues- Xylem - Primary and Secondary xylem. Tracheids, Vessels and Fibers. Phloem-Primary and Secondary Phloem. Sieve cell and Sieve tube element.

Unit-II

Meristems, types of meristems, apical meristems and their organization – Apical Cell theory, Histogen theory, Tunica Corpus theory, Cytological Zonation theory, Root apex- quiescent center.

Unit-III

Vascular Cambium- origin, cell types – fusiform initial and ray initial, storied and non-storied cambium. Seasonal activity, function. Primary and Secondary structure in stem and root of dicot and monocot. Anomalous secondary in the stem of *Nyctanthus*, *Dracaena* and *Achyranthes*.

Unit-IV

Leaf – variation based on symmetry, environment, photosynthetic process. Stomatal type, Venation and Abscission.

Unit-V

Principles of Microscopy: Scanning and Transmission Electron Microscopy, Micrometers and Camera Lucida. Anatomical Techniques: Sectioning, Staining (double staining-any two schedules); Clearing of leaves, Peeling, Maceration.

Practicals:

1. Simple tissues, Shoot, Root apical organization.
2. Dicot stem and root primary and secondary structure.
3. Monocot stem and root primary structure.
4. Vascular cambium-stratified, nonstratified.
5. Anomalous secondary structure: of *Nyctanthus*, *Dracaena* stem and *Achyranthes* root.
6. Internal structure of leaf - Dicot and Monocot.
7. Types of stomata: Anomocytic, Anisocytic, Paracytic, Diacytic and grass type.

Text books:

1. Pandey, B.P. 2001. A Textbook of Botany: Angiosperms. S. Chand & Co. New Delhi- 821 pages
2. Cutter, J.D. 1988. Plant Anatomy. Part I &II, Edward Arnold London.
3. Fahn, A. 1982. Plant Anatomy. Pergamon Press U.K.
4. Johaneson, D.A. 1940. Plant microtechnique - Mc. Graw Hill Book Co., Inc. New Delhi.
5. Cutler D. F, Botha T, Edward C, Botha J. 2008, Plant anatomy: an applied approach,-302 pages
6. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cumming Pub.U.S.A.
7. Pandey, B.P. 1972. Plant Anatomy. S. Chand & Co. New Delhi
8. Esau, K. 1977. Anatomy of Seed plants. John Wiley & Sons, U.S.A.

PAPER-VI : DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS

Course Objective:

- To understand reproductive mechanisms of plants

Unit-I

Flower a modified Shoot, Structure, Development and varieties of flower, functions. Structure and development of microsporangium, Tapetum- Amoeboid and Secretary. Development of male gametophyte, pollen- structure and function.

Unit-II

Structure and development of Megasporangium (Ovule), types of ovules- Megasporogenesis; Female Gametophyte- Structure, development and types (Monospric –*Polygonum*, Bisporic-*Allium*, Tetrasporic-*Pepromia*).

Unit-III

Pollination, Fertilization, Endosperm: Nuclear, cellular and Helobial; Endosperm haustoria, Ruminant endosperms.

Unit IV

Embryo: structure and development of dicotyledonous embryo (*Capsalla*) and monocotyledonous embryo (other than grass), Parthenocarpy – Apomixis and Polyembryo

Unit-V

Seed structure and development, seed appendages. Fruit development, types of fruits. Dormancy : Importance and types of dormancy, seed dormancy, overcoming seed dormancy, bud dormancy.

Practicals:

1. Study of anther of various stages of development, stages of microsporogenesis. Pollen types from permanent slide and photographs
2. Study of T.S. of ovary, L.S. of ovules , types of ovules, types of embryo sacs and development of embryo from permanent slide and photographs
3. Type of endosperms and endosperm haustoria, ruminant endosperm.
4. Study of Stigma and stylar structures.
5. Simple experiment to show vegetative propagation; leaf cutting in Bryophyllum, Sansevieria, Begonia; stem cutting in rose, money plant, sugarcane, and Bougainvillea.

Text books:

1. Pandey, B.P. 2001. A Textbook of Botany: Angiosperms. S. Chand & Co. New Delhi- 821 pages
2. Bhojwani. S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. Vikas Publishing House (P) Ltd.New Delhi. 4th revised edition.
3. Dwivedi, J.N. 1986. Embryology of Angiosperms. Rastogi & Co. Meerut.
4. Johri, B.M. 1992. Embryology of Angiosperms. Springer-Verleg, Berlin.

5. Hartman, H. T. and Kester, D.E. 1976. Plant Propagation: Principles and Practices, 3rd edition. Prentice Hall of India Pvt. Ltd, New Delhi.
6. Proctor and Yeo, P. 1973. The Pollination of Flowers. William Collins Sins, London.
7. Fageri, K and Van der Piji 1989. The Principles of Pollination Ecology. Pergamon Press, Oxford, UK.

Paper-VII Diversity of Angiosperms and their Systematics

Course Objectives:

- To understand the morphological characteristics of the angiosperms
- To learn the nomenclature, classifications, principles and techniques in taxonomy
- To familiarize the locally available plant species

Unit –I

Morphology of roots, stems, leaves, inflorescence, flowers and fruits, angiosperms origin and evolution. Some examples of primitive angiosperms.

Unit –II

A history of angiosperm classification- Artificial, Natural and Phylogenetic systems of classification. An outline of Linnaeus, Bentham and Hooker and Engler and Prantl systems of classification and their merits and demerits.

Unit –III

Plant Nomenclature and its importance, Taxonomic hierarchy. Binomial and Polynomial. ICBN, Author Citation, Principles of priority, Citation, Type concept.

Unit –IV

Identification, Principles of construction of keys and taxonomic literature. Field and Herbarium methods: Collection, pressing, drying, poisoning, mounting and preserving of plant specimens,

Unit – V

Study of the following Angiosperm families and their economic importance: Annonaceae, Cappariaceae, Rutaceae, Anacardiaceae, Leguminosae (Faboideae, Caesalpinioideae, and Mimosoideae) Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Arecaceae and Poaceae.

Practicals:

1. Identification and drawing of vegetative and floral parts of plants belonging to the families mentioned in the syllabus.
2. Description of plants in technical terms from the families mentioned in the syllabus.
3. A field trip for seven days during the academic year under the guidance of teachers.
4. Collection and submission of 15 herbarium sheets belonging to the families mentioned in the syllabus along with field notebook.

Text books:

1. Mabberley D.J. 2008. Mabberley's Plant-book Cambridge University press, Cambridge- 1040 pages.
2. Singh, G. 2005. Plant Systematics – Theory and Practice. Oxford & IBH, New Delhi.
3. Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. The Macmillan Company. New York.
4. Naik, V.N. 2000. Taxonomy of Angiosperms. Tata McGraw- Hill Publishing Company. New York.
5. Vashista, P.C 1991. Taxonomy of Angiosperms. S. Chand & Co. New Delhi.
6. Davis, P. H. and Heywood, V. H. 1973. Principles of Angiosperm Taxonomy. Robert E. Kreiger Pub. Co., New York.
7. Henry A.N, M. Chandrabose. 1980. An aid to International code of Botanical Nomenclature. Today & Tomorrow's Printers and Publishers. New Delhi.
8. Hutchinson, J. 1973. The Families of Flowering Plants. 3rd Edition. Oxford University Press. Oxford.

PAPER-VIII CELL BIOLOGY

Course Objectives:

- To understand the structure of the plant cell
- To understand the process of the cell cycle
- To get training in the histochemical techniques

UNIT-I

Diversity of cell size and shape. Cell theory. Ultra structure, functions and biosynthesis of organelles- cell wall, Endoplasmic reticulum, Golgi apparatus, Mitochondria, Lysosomes, Peroxisomes and Vacuoles.

UNIT-II

Plasma membrane -chemical composition. The lipid bilayer-membrane proteins and carbohydrates. Membrane transport mechanism. Histochemical Techniques: Localization of carbohydrates, proteins, lipids and lignin.

UNIT-III

Nucleus, Nucleolus, Chromosomes, Nucleosome, Salivary & lamp brush chromosomes. The Cell cycle-Mitosis: - S-Phase, G1-phase, interphase, prophase, metaphase, anaphase, telophase, mitogen, microtubules, tubulins, centromere, kinetochore and cytokinesis.

UNIT-IV

The reproductive cycle- Stages of meiosis, significance of meiosis: - Chromomere, synapsis, synaptonemal complex, synaptomeres, lateral element, central element, transverse elements, chiasma and recombination.

UNIT-V

Numerical changes in chromosomes – Aneuploidy and Euploidy :- Monosomy, nullisomy, trisomy, tetrasomy, Down's syndrome, autopolyploid, haploid, colchicines.

Practicals:

1. Observation of plant cells onion peel, hydrilla leaf and stamina cells of Rhoeo
2. Preparation of Root Tip squash and identification of stages in mitosis
3. Preparation of smear of anther and identification in meiosis
4. Examination of electron micrograph of eukaryotic cells with special reference to organelles.
5. Histochemical localization of starch, protein, lipid and lignin.

Text books:

1. Gerald Karp. 2002 Cell and Molecular Biology, John Wiley & Sons, New York
2. Geoffery. H. Cooper et al., 2004. Cell – Molecular approach, ASM press, Washington.

3. Gupta, P.K. 2004. Cell and Molecular Biology. Third Edition. Rastogi Publications.
4. Sharma, A.K and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering, Harwood Academic Publications, Australia.
5. Verma, P.S and Agarwal, V.K. 1993. A Textbook of cytology. S. Chand & Co, New Delhi.
6. Dnyansagar, V.R. 1987. Cell and Molecular Biology. Holt Saunders International, New York, USA.
7. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. Viswanathan (Printers & Publishers) PVT Ltd, Chennai

PAPER - IX PLANT PHYSIOLOGY

Course Objectives:

- To acquire the basic knowledge needed for proper understanding of plant functioning.
- To make the students realize the importance of all physiological processes which take place in plants.

Unit I

Water Relations: Importance of water—imbibition, diffusion and osmosis- water absorption and transport – active and passive absorption –Transpiration: mechanism of stomatal movement. - Factors affecting transpiration - guttation. Solute Relations: Mineral nutrition – Role of Major and Minor elements in plant nutrition- mineral uptake, deficiency and toxicity symptoms.

Unit II

Photosynthesis: Photosynthetic apparatus and pigment systems – Red drop and Emerson effect – photochemical reactions: Cyclic and non-cyclic photo phosphorylation. Carbon fixation: C_3 , C_4 and CAM pathways – factors affecting photosynthesis-photorespiration

Unit III

Respiration: Respiratory substrates –RQ- Aerobic respiration –Glycolysis – TCA cycle– electron transport and oxidative phosphorylation – pentose phosphate pathway – Fermentation - factors affecting respiration.

Unit IV

Nitrogen metabolism: Nitrogen fixation: Symbiotic and asymbiotic fixation- importance of nitrate reductase and its regulations - ammonia assimilation. Protein synthesis, Lipid metabolism: Distribution of fats in plants – synthesis of fatty acids and glycerol – Catabolism of fats: β – oxidation. storage and mobilization of fatty acids.

Unit V

Growth: Phases of growth – factors affecting growth – Plant growth regulators – auxins, gibberellins, cytokinins , abscissic acid and ethylene and their physiological role. Plant movements, Physiology of flowering: Photoperiodism – Vernalization. Circadian Rhythms in plants. Seed dormancy: Causes and methods of breaking dormancy. Physiology of fruit ripening.

Practicals:

1. Demonstration of osmosis by potato Osmoscope.
2. Determination of Osmotic potential by plasmolytic method.
3. Determination of water potential by gravimetric method.
4. Effect of light intensity on photosynthesis

5. Effect of monochromatic light on photosynthesis
6. To determine rate of photosynthesis under variable carbon dioxide concentration.
7. Separation of Chloroplast pigments using Paper Chromatographic technique.
8. Separation of Chloroplast pigments by solvent method.
9. To compare the rate of respiration of various plant parts.
10. Differentiation of C₃ and C₄ plants by starch test.
11. Differential transpiration of leaf surfaces using Cobalt chloride method.
12. Demonstration of fermentation using Kuhne's flask
13. Determination of growth curve by leaf area method.

Text books:

1. Gupta, N.K and Gupta, S.2005. Plant Physiology. Oxford &IBH Publishing Co. Ltd., New Delhi
2. Mukherji. S. and Ghosh, A.K. 2005. Plant physiology. New Central Book Agency Ltd. Kolkata
3. Pandey, S.N and Sinha, B.K. 1989. Plant Physiology, Vikas Pub. House . New Delhi.
4. Noggle G.R.& Fritz,G.J.1986.Introduction Plant Physiology, 2nd Ed. Prentice-Hall of India Ltd., New Delhi.
5. Jain, V.K. 1988. Fundamentals of Plant Physiology, S.Chand and Co. Ltd.,New Delhi.
6. Sundararajan, S. 2000.Plant Physiology. Anmol Publication Ltd. New Delhi.
7. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. Asia Ltd. Singapore.
8. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology, 4th Ed. CBS Pub. Delhi.
9. Verma, S K. A Textbook of Plant Physiology, Biochemistry & Biotechnology. S. Chand & Co. 768 pages

PAPER – X PLANT BIOCHEMISTRY AND BIOPHYSICS

Course Objectives:

- To understand the structure and properties of various Biomolecules available in plants
- To understand various concepts involved in Biophysics.

Unit I

Carbohydrates – Classification – Monosaccharide: chemistry and properties of glucose, formula of glucose – linear form and ring form, Haworth's projection formula. Oligosaccharide: chemistry and properties of Sucrose. chemistry and properties of homopolysaccharide: Starch and cellulose. Chemistry and properties of heteropolysaccharide: vegetable 'gums' and Agar-agar.

Unit II

Lipids- Classification – structure and properties of saturated and unsaturated fatty acids and cholesterol. Amino Acids – Classification – properties – structure and function with special reference to Glycine, Alanine, Glutamic acid, Tryptophan and Methionine. Protein structure: Primary, Secondary, Tertiary and Quarternary structures – Classification and properties of protein.

Unit III

Enzymes – Classification – Physico-chemical properties – Mechanism of enzyme action – Theories of enzyme action – enzyme activation and inhibition – coenzymes. Regulatory enzymes: Non covalently regulated enzymes (allosteric enzymes)-Covalently regulated enzymes. Vitamins – Classification – properties – Vitamins with coenzyme function. Pigments: Structure and properties of Chlorophyll, Carotenoids, Phycobilins and Anthocyanin

Unit IV

Atomic structure; nature of chemical bonding, – types of chemical bonding, bond strength and bond energy, electrostatic force, Van der Waals interactions. Membrane transport: water potential, components of water potential, water potential of cells at different conditions, osmotic potential and pressure potential.

Unit V

Bioenergetics: Energy, free energy, laws of thermodynamics, entropy, chemical equilibrium, redox reactions in biological systems and its importance, oxidation-reduction potential. Photobiology: Electromagnetic spectrum –different colours of light, absorption spectrum, Action spectrum-Excited Singlet State, Fluorescence and Phosphorescence. Mechanism of light absorption and emission. Bioenergetics of light reaction.

Practicals:

Biochemistry:

1. Finding out pK_a value of alanine.
2. Quantitative estimations for amino acids, Carbohydrate and Proteins.
3. Quantitative estimation of soluble sugars and insoluble starch.
4. Separation of amino acids and sugars by paper chromatography.
5. To study the Enzyme activity –Amylase, catalase.
6. To determine the saponification number and iodine number in lipids.
7. Estimation of palmitic acid content

Biophysics:

1. To study the effect of temperature and organic solvents on permeability of plasma membrane.
2. To prepare absorption spectrum of isolated chloroplast pigments.

Text books:

1. Lea, P.U. and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology. John Wiley and Sons, New York.
1. Lehninger, A.L. 2008. Principles of Biochemistry, 5th Ed. W.H. Freeman.
2. Salisbury, F.B and Ross, C.W. 1992. Plant Physiology (4th Edition) Wadsworth Publishing co, USA
3. Vasantha Pattabhi and Gautham, N. 2002. Biophysics. Narosa publishing House, Chennai.
4. Jayaraman, J. 1981. Laboratory Manual in Biochemistry. Wiley Eastern Limited, New Delhi.
5. Conn, E.E, Stumpf, P.K, Bryening, G and Doi, R.h Outlines of Biochemistry 5/E. John Wiley & Sons, New York.
6. Sadasivam, S and Manikam, A. 1992. Biochemical Methods for Agricultural Sciences. Wiley Eastern Ltd. New Delhi
7. Daniel, M. 1989. Basic Biophysics for Biologists. Agro-Botanical Publishers, Bikaner.
8. Thiravia Raj, S. 1995. Biophysics. Saras Publications, Nagercoil.

PAPER – XI ECOLOGY AND UTILIZATION OF PLANTS

Course Objectives:

- To understand ecological concepts of plants and their environments.
- To understand the importance and utilization of plant resources

Unit I

Vegetation & Ecological Factors – Water, light, temperature, topographic factor, soil. Plant adaptation – Soil – Plant – atmosphere – continuum (SPAC), Adaptation to land plants, Ecological groups of plant – Hydrophytes, Mesophytes, Xerophytes, Vernalization and , Photoperiodism

Unit II

Ecosystem & Community Ecology – Characteristics of community, Characters (analytical and Synthetic) used in community study, Ecological Succession, Kinds of Ecosystem, Structure & function of Ecosystem, Food chain, Food web, Ecological pyramid, Productivity, Fresh water Ecology, Marine Ecology, Estuarine Ecology , Desert & terrestrial Ecology

Unit III

Mineral cycling in Ecosystem & Pollution – Biogeochemical cycle, Hydrologic cycle, Carbon cycle, Nitrogen Cycle, Phosphorus Cycle, Environmental Pollution, Causes & control of Air Pollution, Water Pollution & soil Pollution .

Unit IV

Utilization of Plant Resources: Plant resources – wild and cultivated resources – values of plant resources: food, fodder, timber, medicinal, ornamental, ethical, and aesthetic and option values, sustainable utilization of plant resources.

Unit V

Over exploitation and its associated events: Over exploitation - Green revolution and its positive and negative impacts, Grain drain, genetic erosion, deforestation, Green house effect, Global Warming, Sea level raise, Habitat loss, Man and Wildlife conflicts, species extinction and threatened species.

Practicals:

1. To estimate the moisture content and pH value of the given soil sample
2. To determine the minimum size of the quadrat by ‘Species – Area- Curve method.
3. To study the community by quadrat method by determining frequency, density, abundance & Importance Value Index (IVI) of different species present in the community

4. To study of local pond ecosystem
5. Study of locally available plant resources (at least five members in each category) and documenting them by undertaking field visits.

Text books:

1. Singh, J.S, Singh, S.P and Gupta, S.R. 2006, Ecology, Environment and resource conservation, Anamaya Publication, New Delhi 688p.
2. Krishnamurthy K.V. 2004. An advanced text book on Biodiversity; Principles and practice, Oxford and IBH, New Delhi. 260pp.
3. Groombridge, B. (Ed). 1994. Global Biodiversity: Status of Earths Living resources, Chapman & Hall, London.
4. Sharma, P.D. 2000. Ecology and environment. Rastogi Publ. 660 pages
5. Miller, G.T. Jr. 2004. Environmental Science. Thomson, California.
6. Kumar U and Asija M. Biodiversity: Principles and Conservation (2nd Edn), Agrobios by.

PAPER XII - GENETICS AND PLANT BREEDING

Course Objective:

- To understand the basic theoretical concepts and techniques of Genetics and Plant breeding

GENETICS

Unit I.

History and scope of genetics, Mendelian principle of inheritance, Interaction of genes, multiple alleles in man and plants

Unit II.

Linkage and crossing over, two and three point test crosses and their significance, Interference and coefficient of coincidence, Quantitative genetics and descriptive statistics

Unit III.

Sex chromosome in man and melandrium, Mechanism of sex determination, sex-linked inheritance in man, sex-linked traits, maternal influence on inheritance in snails and paramecium, cytoplasmic inheritance in yeast and mirabilis

Unit IV.

Mutation- spontaneous and gene mutation, mutagen types and their actions, molecular mechanism of gene mutation, origin, types and effects of structural and numerical changes in chromosomes and significance of polyploidy in crop improvement

PLANT BREEDING

Unit V.

Types of plant reproduction- vegetative, sexual and apomixes; their effect on generating and fixing genotypic variation, methods of plant improvement- pure line and mass selection; hybridization in self and cross- pollinated crops; introduction and acclimatization; hybrid vigour

Practicals:

1. Training in solving problems as mentioned in the syllabus
2. Demonstration of vegetative propagation methods
3. Study of numerical and structural variations of chromosomes from photographs and charts
4. Demonstration of hybridization techniques—emasculation and bagging of flowers, pollinating them manually
5. Testing of seeds for viability and germination
6. Visit to Plant breeding stations

Text books:

1. Vijendra Das L.D. 2006. Genetics and Plant Breeding, New Age International, New Delhi 288 pages
2. Herbert Kendall Hayes. 2007. Methods of Plant Breeding, Kosta press, USA , 448 pages
3. Gupta, P.K. 1997. Cytology, Genetics & Evolution. Rastogi Publications, Meerut
4. Gardener, J, Simmons, H.J and Snustad, D.P. 1997. Principle of Genetics, John Wiley & Sons, New York. 829pp.
5. Sharma, J.R. 1994. Principles and Practices of Plant Breeding. Tata McGraw Hill Publishing Co.Ltd., New Delhi.
6. Dnyansagar, V.R. 1986. Cytology and Genetics. Tata McGraw Hill Publishing Co.Ltd., New Delhi. 403pp.
7. Ursula Goodenough, 1998. Genetics. Saunders college Publishing Co., Philadelphia, USA

PAPER XIII - Biostatistics and Computer applications in biology

Course Objective:

- To understand the basic theoretical concepts and techniques in Biostatistics and computer applications in biology

Biostatistics

Unit I

Introduction to Biostatistics, definition, characteristics, importance and usefulness, limitations. Variables in biology; collection, classification and presentation of data (tabulation, graphical representation-Histogram, simple bar, multiple bar and divided bar diagrams, pie diagram, frequency curve and frequency polygon). Frequency distribution-definition, types, class width, class mark, class frequency, relative frequency, percentage frequency and frequency density.

Unit II

Measures of central tendency- Characteristics –definition and calculations of mean, median and mode. Measures of variation – standard deviation and standard error.

Computer applications in biology

Unit III

Introduction to computers: Types of computers, accessories and its functions, input-output devices, concepts of different operation systems, details of Networks, internet & email. Databases types and its uses, fundamentals of digital imaging, uses of different programming languages.

Unit IV

Computers and Biology: Introduction to Bioinformatics and its applications, EMBL and GenBank Data libraries, PIR Database, Fundamentals of Geographic Information Systems (GIS) and Remote Sensing and its uses in biology, Information systems – BTIS, ENVIS.

Unit V

Softwares used in Biology: Outline of MS-Office (MS-Word, MS-Excel and MS-Power point), Database softwares – MS access, Image editing softwares (Photoshop), Biological Sequence searching and comparison softwares (Blast), Search engines (Google), GIS Softwares (Google Earth).

Practicals:

1. Tabulation of biological data
2. Calculation of mean, median, mode, Standard deviation and standard error using biological data.

3. To plot and import Graphs and charts using biological & stactical data in MS-office
4. Search biological information (Texts and images) using internet
5. Biological sequence searching using Blast software

Text books:

1. Banarjee, P.K.. 2009. Introduction to Biostatistics (A text book of Biometry) by, S.Chand & Co, New Delhi
2. Shah Y. I, Paradkar A. R, Shah Y. I, Dhayagude M. G. 2008Introduction To Biostatistics & Computer Science, Nirali Prakashan, Pune, 260pp.
3. Goswami, R. .2009. Biostatistics & Computer Applications. MD Publications, 251 pages
4. Fundamentals of Computers by Rajaraman, 4th Edition, Prentice Hall of India.
5. Norton, P. 2001. Introduction to Computers (Special Indian Edition), Tata McGraw Hill (India) Ltd, New Delhi
6. Introduction to Computers, by Alexis Leon, Mathews Leon, Vikas Publishing House, New Delhi
7. MS Office 2007 by Rutkosky, BPB Publication, New Delhi
8. Genebank: <http://www.ncbi.nlm.nih.gov/Genbank/>
9. EMBL Nucleotide Sequence Database <http://www.ebi.ac.uk/embl/>

PAPER – XIV MICROBIOLOGY

Course Objectives:

- To learn the basic techniques involved in the isolation and cultivation of microbes. To enable the students to identify microorganisms by cultural characteristics and staining procedure.

Unit I

Types of microorganisms –Salient features- Algae, Fungi, Protozoa, Bacteria, Viruses and Mycoplasma. Important developments in Microbiology - Major groups of bacteria as per Bergey's Manual of systematic Bacteriology 8th edition.

Unit II

Morphology and fine structure of bacteria – Nutritional types of bacteria – Growth: sigmoid growth, factors affecting growth - Reproduction of bacteria: Binary fission. Methods of recombination: Conjugation, Transduction and Transformation. Economic importance. Bacterial virus: Structure and reproduction of T4 Phage – Plant virus: TMV. Structure and multiplication .General account of Mycoplasma.

Unit III

Types of culture media - Preparation of cultures – sterilization methods – pure culture technique – Staining: Simple staining and Gram staining – flagellar staining-Capsular staining. Preservation of microbial cultures.

Unit IV

Soil Microbiology: Rhizosphere and rhizoplane microorganisms – organic matter decomposition – composition of litter -. Biogeochemical cycling: Carbon, Nitrogen, Phosphorus and Sulphur cycling.

Unit V

Agaricultural microbiology: production of bacterial biofertilizer, Green manuring: Mass cultivation of Cyanobacterial biofertilizer, Mass cultivation of *Azolla*, Production of Mycorrhizal biofertilizer. Industrial Microbiology: Role of microorganisms in the production of alcohol, organic acids, milk products, antibiotics, biopesticides, food processing and sewage disposal.

Practicals:

1. Sterilization techniques & Preparation of culture media: Basic & substituted.
3. Isolation and purification of microorganisms.
4. Quantification of soil microbes by plating technique .
5. Motility of bacteria by hanging drop method.
6. Staining: simple staining and Gram staining
7. Demonstration of acid and gas production technique by bacteria.

8. Micrometry (measurement of Yeast, *Lactobacillus*, Cyanobacteria, fungal spores)
9. Determination of microbial growth (direct measurement of colony and spectrophotometer method).
10. Observation of Virus infected plants.

Text books:

1. Prescott,L,M, Harely, J.P, and Klein, D.A. 2002. Microbiology, 5th Ed. McGraw Hill Science, Inc.,New York.
2. Dubey R.C. and Maheshwari, D.K. 2010. A Textbook of Microbiology. S. Chand & Co, Ram Nagar, New Delhi, pp. 1032.
3. Pelczar, M.J., Chan, E.C.S, Krieg, N.R. 1993. Microbiology – Concepts and Applications, McGraw-Hill,Inc., New York.
4. Aneja,K.R. 1993.Experiments in Microbiology, Plant Pathology and Tissue Culture. Wishwa Publication,New Delhi.
5. Ananthanarayan,R and C.K. Jayaram Paniker .1996. Text book of Microbiology. Orient Longman, Hydrabad.

PAPER XV - MOLECULAR BIOLOGY

Course Objective:

- Objective of course is to understand the basic theoretical concepts and techniques of Molecular Biology

Unit I.

Introduction and scope of molecular biology, concepts of basic techniques of molecular biology concerned with DNA, RNA and Proteins, ideas of applications of basic instrumentations in plant molecular biology

Unit II.

Nucleic acid technology- Physical and chemical structures of DNA, different forms of DNA, nucleosome model of DNA and protein interaction, DNA denaturation and renaturation, multiple copies of base sequences and repeated sequences in eukaryotes, depolymerization of nucleic acids

Unit III.

Models and mechanism of DNA replication, Transcription in prokaryotes and eukaryotes, structure and types of RNA, RNA splicing and transport, genetic code, mechanism of translation.

Unit IV.

Gene regulation- positive and negative gene regulation in lactose system, operon and tryptophan model, suppressor and overlapping genes, promoter, operator and interrupted genes, transcription factors

Unit V.

Recombinant DNA and Genetic engineering- Principle and techniques of gene cloning, cloning vectors, screening and selection of transformants, methods of library construction (genomic/ c-DNA), Techniques of transgenic crop production, basic concept of genomics and proteomics

Practicals:

1. Colorimetric estimation of DNA using diphenylamine
2. Colorimetric estimation of RNA using orcinol
3. Estimation of total RNA from plant tissues and its colorimetric estimation

Text books:

1. David Freifelder. 2008. Essentials of Molecular Biology, Narosa Publishing House, New Delhi
2. Gerald Karp. 2002 Cell and Molecular Biology, John Wiley & Sons, New York

3. Geffery. H. Cooper et al., 2004. Cell – Molecular approach, ASM press, Washington.
4. Gupta, P.K. 2004. Cell and Molecular Biology. Rastogi Publications. Third Edition.
5. Sharma, A.K and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering, Harwood Academic Publications, Australia.
6. Verma, P.S and Agarwal, V.K. 1993. A Textbook of cytology. S. Chand & Co, New Delhi.
7. Dnyansagar, V.R. 1987. Cell and Molecular Biology. Holt Saunders International, New York, USA.
8. Kumar, H.D. Molecular Biology and Biotechnology, Vikas Publishing House, New Delhi
9. Bioinformatics: Sequence and Genome Analysis. Mount D, Cold Spring Harbor Laboratory Press, New York, 2004

PAPER – XVI PLANT BIOTECHNOLOGY

Course Objectives:

- To familiarize the students with the basic principles and techniques in tissue culture.
- To orient student learning towards application and career options in the field of biofertilizers. To impart knowledge on safe handling and maintenance of transgenic plants and products.

Unit I

Tissue culture: Totipotency – Tissue culture lab, designs – media preparation – MS medium – organic and inorganic constituents – growth regulators – gelling agents, sterilization methods – Explant types. Callus culture – organogenesis – direct and indirect – meristem culture – Apical and Axillary bud culture – micropropagation – anther and embryo culture – Hardening – Protoplasts: isolation and culturing of protoplasts – Somatic embryogenesis and hybridization - applications.

Unit II

Biofertilizers: Definition – Organisms involved – Bacteria: *Rhizobium*, *Azotobacter*, *Azospirillum* and Phosphobacteria. Isolation, characterization, identification, mass cultivation and inoculation method. Genetics of Nitrogen fixation. *Klebsiella pneumoniae* – Symbiotic bacteria – *Rhizobium*.

Unit III

Cyanobacterial Biofertilizer: Algalization – mass cultivation of Cyanobacterial biofertilizers – mass production of carrier based immobilized Cyanobacterial inoculants. *Azolla* – Morphology – Mass cultivation and application. Mycorrhizal fungi – Ecto, Endo – sources of inoculum and methods of application.

Unit IV

Gene transfer in Plants: Marker genes, Reporter genes, Gene transfer methods –Ti plasmid, *Agrobacterium* mediated DNA transformation – Transgenics in crop improvement: herbicide-resistance, Glyphosate resistance, Pest resistance, disease resistance plants, Mitochondrial and chloroplast transformation, Cytoplasmic male sterility – delayed fruit ripening, edible vaccines, interferon production in plants. Stress tolerant plants.

Unit V

Cloning Techniques and Cloning Vectors, Construction and selection of genomic library/cDNA library, cloning for the production of edible vaccine and interferon. Future prospects for GM crops – the current state of transgenic crops – concerns about GM crops – the regulation of GM crops and products. Golden rice. Advantages and disadvantages of using plants as bioreactors. Medical pharming: Plantibodies and Edible vaccines. Non-medical Pharming – Industrial enzymes. Bioplastics and biotechnology.

Practicals:

1. Preparation of tissue culture medium (MS medium),
2. Preparation of explant
3. Callus induction from the leaf explants of *Datura*.
4. Shoot initiation from *Datura* callus
5. Root initiation from in vitro formed shoots of *Datura*.
6. Demonstration of technique of anther culture.
7. Isolation of N₂ fixing *Rhizobium*, *Azotobacter*, *Azospirillum* and Phosphate solubilizing bacteria from soil
8. Mass cultivation and inoculation methods for bacterial and blue-green algal biofertilizers.
9. Isolation of Mycorrhizal fungi.
10. Mass cultivation and application of *Azolla*
11. Demonstration of PCR techniques – RAPD analysis in plants.
12. Demonstration of *Agrobacterium* mediated DNA transfer

Suggested Readings

1. Nirmala, C.B., G. Rajalakshmi and Chandra karthick. 2009. Plant Biotechnology. MJP publishers, Chennai
2. Chawla, H.S. 2008. Introduction to plant Biotechnology. Oxford & IBH publishing co., Pvt. Ltd. New Delhi.
3. Ramawat, K.G. 2000. Plant Biotechnology, Chand & Co. New Delhi
4. Adrian Slater, Nigel Scott and Mark Fowler, 2004. Plant Biotechnology – The genetic manipulation of plants – Oxford University Press.
5. Chawla, H.S. 2008. Introduction to plant Biotechnology Oxford & IBH publishing co. Pvt. Ltd., New Delhi.
6. Subha Rao, N.S. 2003. Soil Microbiology 4th ed. Oxford & IBH Publishing Co. Pvt Ltd. New Delhi.
7. Old, R. W. and S. B. Primrose. 2000. Principles of gene manipulation. An introduction to genetic engineering. 5th ed. Blackwell Science Ltd. Oxford.
8. Winnacker, E.N. 2003. From genes to clones. Panama publishing corporation. Pvt. Ltd. New Delhi.
9. Venkataraman, G.S. 1972. Algal biofertilizers and rice cultivation. Today & tomorrow's printers & publishers.
10. Kannaiyaan, S. 2002. Biotechnology of Biofertilizers. Narosa publishing house, New Delhi.

PAPER – XVII: MEDICAL BOTANY

Objectives:

- This study enriches the knowledge on traditional medicinal systems as well as rich herbal diversity.
- This study will be useful in identifying medicinal taxa.
- This study will be useful in standardization of herbal drugs.

Unit-1:

Introduction, historical back ground, present status, scope of medicinal botany, Indian contribution to medicinal botany , Ethnobotany, a brief outline on traditional systems of medicine – Ayurvedha, Siddha, Unani and Homeopathy.

Unit-2:

Pharmacognocny, crude drug classification, drug adulterations and substitutions, identification of drugs by anatomical, histochemical and phytochemical methods.

Unit-3:

Plant secondary metabolites of medical importance: source, description of the products, chemical constituents, active principles and therapeutic uses of the following.

- Carbohydrates** - Ispaghula (*Plantago ovata*), Agar
- Glycosides** - Senna (*Cassia* sp), *Digitalis* and *Glycorrhiza*
- Tannins** - *Acacia*, Myrobalan(*Terminlia chebula*)
- Fixed oils** - Groundnut oil (*Arachis hypogea*),
Castor oil (*Ricinus communis*)
- Volatile oils** - *Eucalyptus*, Clove, lemon and *Ocimum*
- Resins** - Asafoetida and *Pinus*
- Alkaloids** - *Cinchona*, *Rauwolfia*, *Atropa*, *Opium*, *Vasaka* (*Adhatoda zeylanica*), *Ephedra* and Ergot.of rye
- Steroids** - *Solanum*, *Dioscorea*

Unit-4:

Toxins of plant origin: Allergens, Teratogens and hallucinogens from hemp and fungi.

Unit-5:

Antibiotics: Extraction, chemistry and therapeutic uses of the antibiotics obtained from *Penicillium*, *Aspergillus*, bacteria and *Streptomyces*.

Suggested Laboratory Exercises:

1. Morphological and anatomical studies of crude drugs of plants included in the syllabus.
2. Identification of crude drugs by histochemical and phytochemical methods.

3. Identification of drug adulterants.

Suggested Readings:

1. Khare, C.P. (Ed.), 2007. Indian medicinal plants: An Illustrated Dictionary, Springer, New York. 836p.
2. Joshi, S.G. 2000 Medicinal plants. Oxford and IBH, New Delhi.
3. Rastogi, R.R. and B.N. Mehrotra. 1993. Compendium of Indian Medicinal plants. Vol.I & Vol.II. CSIR, publication and information directorate, New Delhi.
4. Kokate, C.K, Purohit, A.P and Gokhale, S.B. 1998. A Textbook of Pharmacognosy. Nirali Prakasan, Pune.
5. Jain, S.K. (ed) 1981 Glimpses of Indian Ethnobotany- Oxford IBH.
6. Jain, S.K. and V.Mudgal. 1999. A Handbook of Ethnobotany. Bishen Singh Mahendra pal singh, Dehradun.
7. Supriya Kumar Bhattacharjee. 1998. Handbook of Medicinal Plants. Pointer publishers, Jaipur.

PAPER – XVIII MARINE BOTANY [SPECIAL PAPER – OPTIONAL]

Course Objective:

- To understand Oceanic habitat, Mariculture and Marine pollution.

Unit I

Different strata of Oceanic habitat- Marine flora: Phytoplankton, Seaweeds and Sea grasses - Distribution pattern of sea weed resources in Indian Seas. Marine Biosphere Reserve and Marine National Park. - Marine Ecotourism

Unit II

Marine food web and food chain - Measuring phytoplankton populations and primary productivity: sampling methods Tracer technique and Chlorophyll measurement. Assessment of Marine resources-Quadrat method, transect method. Parameters in assessment- Biomass, density, percentage occurrence, species abundance, richness and evenness. Role of remote sensing in marine Botany.

Unit III

Mariculture: Methods of seaweed cultivation: Lagoon culture, Coir rope culture and 'Net' cultivation method. Sources, chemistry and extraction of Phycocolloids: Alginates, Agar-agar and Carrageenan. Seaweed manure and Seaweed liquid fertilizers.

Unit IV

Utilization of Macro algae: Major uses of *Porphyra* (Nori or Laver), *Gracilaria* (Kanji Pasi), *Laminaria* (Kombu), and *Ulva* (Sea lettuce). Edible seaweeds. Nutraceuticals : Omega-3 Fatty acids. Fodder: Seaweed meal for Pisciculture, Poultry feed and other farm animals. Uses of Kiesilghur (Diatomite).

Unit V

Types of marine pollution and Eutrophication - Major pollutant: Heavy metals, Pesticides, Oil, Thermal, Radioactive and Plastic. Laws of Marine pollution regulatory act. Water bloom-Red tide-Toxic Dinoflagellates - exo and endo toxins - Bioluminescence.

Suggested Laboratory Exercises:

- 1 laboratory analysis of seawater samples
- 2 Measurement of productivity - Light and Dark bottle method.
- 3 Study of external and internal structure of some available macroscopic seaweeds
- 4 Extraction of agar from red seaweed -*Gracilaria*
- 5 Extraction of alginates from Brown alga - *Sargassum*.
- 6 Extraction of Chlorophylls and Carotenoids from Marine Green Alga- *Ulva*.
- 7 Preparation of Sea Weed Liquid Fertilizers (SLF) from *Sargassum*

8 Effect of SLF on Seed germination.

Suggested Readings:

- 1 Krishnamurthy,V. 2000. Algae of India and neighbouring countries. Oxford & IBM Publ.pp. 203.
- 2 Sundaralingam,V. 1991. Marine Algae, Bishan Singh and Mahendra Pal Singh Publishers, Dehradun.
- 3 Balakrishanan Nair, N and D.M. Thampy.1980. A text book of marine ecology. The Mac Millan co., of India Ltd. pp.352.
- 4 Austin.1992. Marine Microbiology. Cambridge Press.
- 5 Peter McRoy, C. and Helferich,G. 1977. Seagrass Ecosystems. A Scientific respective Marcel Deker Inc., New York.
- 6 Waldichunk. M. 1977. Global Marine Pollution: an Overview.UNESCO. Paris.
- 7 Imai, LT. 1982. Progress in shallow sea culture techniques of seaweed culture. Tokyo: Koseisha Koseika publishers (English translation) pp.111.
- 8 Boney,A.D. 1989. Phytoplankton – New studies in Biology –Edward Arnold – London pp 118.

PAPER-XVIII - BIODIVERSITY AND CONSERVATION [SPECIAL PAPER – OPTIONAL]

Course Objective:

Unit-I

Introduction: Definition, concepts and types of biodiversity, origin of new genetic material, isolation and origin of new species. Isolation mechanisms.

Unit-II

Factors affecting biodiversity: Demography pressures, over exploitation, deforestation, water dams and river valley projects, mines, grazing of grasslands.

Biodiversity informatics: Documenting biodiversity, biodiversity databases-Red data, Blue data and Green Book and Biodiversity registers.

Unit – III

Ex situ Conservation: Principles, seed banks, pollen storage, tissue culture, germplasm bank, vegetative propagation, cultivation involving local and tribal communities, botanical gardens.

Unit-IV

In situ Conservation: principles, biosphere reserves, protected areas network, national parks, sacred groves and wildlife sanctuaries.

Unit-V

Global biodiversity information system- species 2000 and Tree of life – overview of the UNEP/GEF biodiversity data management project (BDM) – CBD and bioethics.

Suggested laboratory Exercisers

10. Visit to national parks, wildlife sanctuaries, sacred groves and tissue culture.
11. Listing biodiversity database
12. Preparation of checklist of Indian flora by referring to IUCN categories.
13. Species 2000 Demo in Internet
14. Tree of life-Demo in internet

Suggested Reading

1. Agarwal , K.C. 2005. Biodiversity Principles and Conservation, International Book Distributors, Dehradun.
2. Krishnamurthy K.V. 2004. An advanced text book on Biodiversity; Principles and practice, Oxford and IBH, New Delhi. 260pp.
3. Groombridge, B. (Ed). 1994. Global Biodiversity: Status of Earths Living resources, Chapman & Hall, London.

4. Chowdhery, H.J. and Murti, S.K. 2000. Plant Diversity and Conservation in India: An overview. Bishen Singh Mahendra Pal Singh Publishers, Dehra Dun.
5. IUCN, 1980. WORLD Conservation Strategy: prepared by IUCN and Natural Sources, UNEP, WWF, FAO, UNESCO.
6. Kandya, A.K. 2007. Biodiversity Conservation and Legal Aspects, International Book Distributors, Dehradun.
7. Kumar, 2005. Biodiversity Principles and Conservation. International Book Distributions, Dehradun.

BLUE PRINT OF QUESTION PAPER FOR B.Sc. PLANT SCIENCE MAIN
(Effective from the academic year 2010-11)

Time – 3 hrs
Max. Marks – 100

Section – A

Answer **all** the questions. Each answer should not exceed 30 words.

Two questions from each unit (10 x 2 = 20 marks)

1. Unit I
2. Unit I
3. Unit II
4. Unit II
5. Unit III
6. Unit III
7. Unit IV
8. Unit IV
9. Unit V
10. Unit V

Section – B

Answer any **eight** questions. Each answer should not exceed 200 words.

Two questions from each unit (8 x 5 = 40 marks)

11. Unit I
12. Unit I
13. Unit II
14. Unit II
15. Unit III
16. Unit III
17. Unit IV
18. Unit IV
19. Unit V
20. Unit V

Section – C

Answer any **four** questions. Each answer should not exceed 600 words.

One question from each unit (10 x 4 = 40 marks)

21. Unit I
22. Unit II
23. Unit III
24. Unit IV
25. Unit V

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BLUE PRINT OF PRACTICAL QUESTION PAPER
FOR B.Sc. PLANT SCIENCE MAIN
(Effective from the academic year 2010-11)

Practical Paper – 1 (Algology, Lichenology, Mycology & Phythopathology)

Time – 3 Hrs.

Max Marks – 40.

1. Make suitable micro preparations of **A, B & C**. Leave the slide for valuation. Identify with reasons.

(Preparation-2, Identification-1, Reasons-2 marks)

(3x5=15 Marks)

2. Draw labeled sketches and identify giving reasons **D, E & F**.

(Identification-1, Diagram-1, Reasons-2marks)

(4x3=12 Marks)

3. Identify **G** giving reasons.

(1x3=03 Marks)

Total for Practical = **30 Marks.**

Record Marks = **10 Marks.**

Total = **40 Marks.**

KEY

A = Alga	(Section)	
B = Fungus	(Section)	
C = Phythopathology	(Section)	
D = Alga	(Slide/Specimen)	
E = Fungus	(Slide/Specimen)	
F = Phythopathology	Slide/Specimen)	
G = Lichens	(Slide/Specimen)	

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Practical Paper – 11 (Bryology, Pteridology, Gymnosperms & Paleobotany)

Time – 3 Hrs.

Max Marks – 40.

1. Make suitable micro preparations of **A, B & C**. Leave the slide for valuation. Identify with reasons.

(Preparation-2, Identification-1, Reasons-2 marks)

(3x5=15 Marks)

2. Draw labeled sketches and identify giving reasons **D, E & F**.

(Identification-1, Diagram-1, Reasons-2marks)

(4x3=12 Marks)

3. Identify **G** giving reasons.

(1x3=03 Marks)

Total for Practical = **30 Marks.**

Record Marks = **10 Marks.**

Total = **40 Marks.**

KEY

A = Bryophyte	(Section)	
B = Pteridophyte	(Section)	
C = Gymnosperm	(Section)	
D = Bryophyte	(Slide/Specimen)	
E = Pteridophyte	(Slide/Specimen)	
F = Gymnosperm	(Slide/Specimen)	
G = Paleobotany	(Slide/Specimen)	

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Practical Paper – 111 (Anatomy of Angiosperms & Development and Reproduction in Flowering Plants)

Time – 3 Hrs.

Max Marks – 40.

1. Make suitable micro preparations of **A & B**. Leave the slide for valuation.
Identify with reasons.
(Preparation-2, Identification-1, Diagram-1, Reasons-2 marks) **(2x6=12 Marks)**
2. Dissect and mount the embryo/endosperm of the specimen **C**.
Leave the slide for valuation. **(1x2=02 Marks)**
3. Draw labeled sketches and identify giving reasons **D, E, F & G**.
(Identification-1, Diagram-1, Reasons-2marks) **(4x4=16 Marks)**

Total for Practical = **30 Marks.**
Record Marks = **10 Marks.**
Total = **40 Marks.**

KEY

A = Anatomy	(Section)	
B = Embryology	(Section)	
C = Embryology	(Section)	
D = Anatomy	(Slide/Specimen)	
E = Anatomy	(Slide/Specimen)	
F = Embryology	Slide/Specimen)	
G =Embryology	(Slide/Specimen)	

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Practical Paper – 1V (Diversity of Angiosperms and their Systematics & Cell Biology)

Time – 3 Hrs.

Max Marks – 40.

1. Describe the given specimen **A** in technical terms. Draw L.S. and Floral Diagram of the Flower. Write the Floral Formula. Assign to its Family giving reasons.

(Identification-1, Description-2, Flower.L.S-1, Floral Diagram-1, Reasons-2 marks)

(1x7=07 Marks)

2. Identify the given specimen **B** to its family giving reasons. Write its Taxonomic hierarchy.

(Identification-1,Reasons-2,Taxonomic hierarchy-2 Marks)

(1x5=05 Marks)

3.Prepare Squash/Smear of the material **C**. Identify any two stages giving reasons.

Leave the slide for valuation.

(Preparation-2,Diagram-1,Reasons-2Marks)

(1x5=05 Marks)

4.Localise the Histochemical substance in the given specimen **D** with suitable histochemical reagents. Identify and submit the slide for valuation.

(Preparation-2,Identification-1,Notes-1 Marks)

(1x4=04 Marks)

5. Draw labeled sketches and identify **E** giving reasons.

(Identification-1, Diagram-1, Reasons-2marks)

(1x4=04 Marks)

Total for Practical = **25 Marks.**

Record Marks = **10 Marks.**

Herbarium = **05 Marks**

Total = **40 Marks.**

KEY

A = Taxonomy	(Section)	
B = Taxonomy	(Section)	
C = Cell Biology	Preparation)	
D = Cell Biology	(Preparation)	
E = Cell Biology	(Slide/Specimen)	

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Practical Paper – V (Plant Physiology, Plant Biochemistry & Biophysics, Ecology & Utilization of Plants, Genetics & Plant Breeding & Biostatistics & Computer Applications in Biology)

Time – 3 Hrs.

Max Marks – 70.

1. Outline the procedure for the given experiment **A**. List the materials required. Set up the experiment and draw. Tabulate the data recorded. Report the results and leave the setup for valuation.

(Set up-3, Procedure-2, List of materials-1, Sketch/Graph-2, Tabulation-2 and Results-2 Marks)
(1x12=12 Marks)

2. Outline the procedure for the given experiment **B**. List the materials required. Set up the experiment and draw. Tabulate the data recorded. Report the results and leave the setup for valuation.

(Set up-3, Procedure-2, List of materials-1, Sketch/Graph-2, Tabulation-2 and Results-2 Marks)
(1x12=12 Marks)

3. Estimate the Importance Value Index (IVI) from the given values in **C**.

(1x6=06 Marks)

4. Solve the given Problem **D**.

(1x6=06 Marks)

5. Solve the given Problem **E**.

(1x5=05 Marks)

6. Solve the given Problem **F** using computer software.

(1x6=06 Marks)

7. Identify, draw and write notes on **G and H**.

(2x4=08 Marks)

Total for Practical = **55 Marks.**
Record Marks = **15 Marks.**
Total = **70 Marks.**

KEY

A	Plant Physiology	(Experiment)	
B	Plant Biochemistry & Biophysics	(Experiment)	
C	Ecology	(Problem)	
D	Genetics	(Problem)	
E	Biostatistics	(Problem)	
F	Computer Exercise	(Problem)	

G	Plant Breeding	(Specimen)	
H	Utilization of Plants	(Specimen)	

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Practical Paper – VI (Microbiology, Molecular Biology, Plant Biotechnology, Medical Botany and Optional Paper)

Time – 3 Hrs.

Max Marks – 70.

1. Stain the preparation **A** with Gram stain. Identify and draw. Write the staining procedure. Leave the slide for valuation.

(Preparation-3, Identification- 1, Procedure-4, Diagram-2 Marks)

(1x10=10 Marks)

2. Isolate/Estimate/Stain the materials from the given specimen **B**. List the materials required. Evaluate and record the results. Leave the preparation for valuation.

(Preparation-3, Procedure-3, List of materials-1, Sketch/Graph-1, Results-2 Marks)

(1x10=10 Marks)

3. Perform the experiment **C**.

[Prepare the tissue culture medium/inoculate the given explant (anther/plant tissue) in the medium]

(Preparation-3, Procedure-3, List of materials-1, Diagram -1, Results-2 Marks)

(1x10=10 Marks)

4. Identify the given material **D** using micropreparation/histochemical/phytochemical methods.

(Preparation-3, Identification-1, Procedure-3, Diagram-2 Marks)

(1x9=09 Marks)

5. Identify, draw and write notes on **E, F, G, and H**.

(Identification-1, Diagram-1, Notes-2 Marks)

(4x4=16 Marks)

Total for Practical = **55 Marks.**

Record Marks = **15 Marks.**

Total = **70 Marks.**

KEY

A	Microbiology	(Experiment)	
B	Molecular Biology	(Experiment)	
C	Plant Biotechnology	(Experiment)	
D	Medical Botany	(Experiment)	

E	Microbiology	(Specimen/Diagram)	
F	Molecular Biology	(Specimen/Diagram)	
G	Plant Biotechnology	(Specimen/Diagram)	
H	Medical Botany	(Specimen/Diagram)	