

UG – SEMESTER – 1

CORE PAPER – I MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY

UNIT – I

Classification of bacteria (Bergey's Manual) based on Morphological characteristics; Ultrastructure of bacterial cell, Chemical composition of cell wall, Principles of Gram staining; Sterilization techniques: Principles and Types: – Physical, Chemical and Radiation.

UNIT - II

Nutrition, growth and reproduction of Bacteria: Modes of cell division; cell formation and endospore formation; nutritional type of bacteria – Autotrophs and Heterotrophy; Normal growth curve (Batch culture); Impact of intrinsic and extrinsic factors on bacterial growth; Recombination – Transformation, Transduction and Conjugation.

UNIT – III

Viruses – Morphology; structure, Types and Classification of viruses; Viral genome; Replication of Bacteriophages; adsorption, penetration, replication, assembly and release (Lytic and Lysogenic cycles). Biological significances of CaMV.

Unit – IV

Fungi – General characteristics of fungi; Classification (Alexopoulos and Mims); Structure, Reproduction and life cycle of *Albugo* sp., *Saccharomyces* sp, *Penicillium* sp., *Puccinia* sp., and *Colletotrichum* sp.; Economic importance of fungi and List of fungal diseases caused in plants.

Industrial application of microbes – Pasteurization techniques, Fermentation of milk & milk products, Vegetables & Fruits, Production of Antibiotics (Penicillin); Production of Organic acids (Citric acid) and Alcohol.

Unit – V

Plant Pathology: Introduction; Classification of plant diseases based on causal organisms; List of bacterial diseases caused in plants. List of viral diseases caused in plants

Pathogenesis and study of the causative organisms, symptoms and the control measures of the following diseases:

1. Tikka disease of groundnut (*Cercospora* sp.)
2. Citrus canker (*Pseudomonas* sp.)
3. Mosaic disease in Tobacco (TMV)
4. Mycoplasma disease (Little leaf of Brinjal)

PRACTICALS:

Microbiology:

1. Calibration of Microscope.
2. Sterilization techniques & Types.
3. Preparation of Basal medium – solid agar and broth
4. Preparation of agar plates, agar slants and agar deep tubes.
5. Isolation and culturing techniques of microbes – streak plate and pour plate methods.
6. Simple staining of bacteria.
7. Gram's staining of bacteria.
8. Isolation of microorganism from air and water.
9. Assessing the milk quality by Methylene Blue Reductase Test (MBRT).
10. Observation of milk and milk products – cheese, butter, ghee, paneer, etc.

Mycology:

Study of morphology and anatomy of the genera as given in the syllabus

REFERENCES:

1. Pelczar, M.J (Jr), Chan, E.C.S and Krieg, N. R (1986). Morphology. Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
2. Scheigel, H. S (1986). General Microbiology, (6th edition). Cambridge University press, London.
3. Sharma, P.D. Microbiology (2nd edition). Rastogi Publication, Meerut.

4. Aneja, K. K. (1996). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, Wishwa Prakashan, New Delhi.
5. Purohit, S. S. (1999) Microbiology Fundamentals and Applications, (6th Edition). Agrobios (India), Jodhpur.
6. Dubey and Mageshwari – Text Book of Microbiology. Schand & Co. Ltd.
7. Alexopoulos, C.J., Mims, C. W. and Blackwel, M. 1996. Introductory Mycology. John Wiley & Sons Inc.
8. Clifton, A. 1958. Introduction of bacteria. Mc Graw Hill Book Co., New York
9. Mandahar, C. L. 1978. Introduction to plant viruses. Chand & Co. Ltd, New Delhi
10. Rangaswamy, G and Mahadevan, A. 1999. Diseases of Crop plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi.
11. B. P. Pandey. Plant Pathology
12. A text book of Plant Pathology – A.V.S.S Sambamurthy, I.K. International Publishing House Pvt. Ltd, New Delhi.

SEMESTER- II

CORE PAPER – II ALGOLOGY, BRYOLOGY AND LICHENOLOGY

Unit-I

Algology:

Classification of algae: General outline proposed by Fritsch; 1935-1945. Detailed study of structure and life cycle of the following: *Nostoc*, *Chlamydomonas*, *Volvox*, *Caulerpa* and *Chara*.

Unit-II

Detailed study of structure and life cycle of the following: *Diatom*, *Dictyota*, and *Polysiphonia*. Economic importance of algae.

Unit-III

Bryology:

Bryophytes: Introduction; general characters; classification of bryophytes (Smith- 1965). Morphology, structure and reproduction of the following: *Marchantia*, *Riccia*, *Porella*, *Anthoceros* and *Polytrichum*

Unit – IV

Evolution of sporophyte and gametophyte; ecological aspects and economic importance of Bryophytes; fossil Bryophytes.

Unit – V

Lichenology:

Lichens: Introduction, types, external and internal structure and reproduction. Biological significances of Lichens.

Practicals:

Study of morphology and anatomy of genera as given in the syllabus

REFERENCES:

1. A Text Book of Botany Singh Pandey and Jain 4th Edition Rastogi Publications 2010.
2. College Botany Dr. B.P. Pandey 5th Edition S. Chand Co., Pvt. Ltd 2013.
3. College Botany, Gangulee and Kar Vol II. New Central Book Agency Pvt. Ltd 2007.
4. Kumar, H.D. 1988. Introductory Phycology. Affiliated East –West Press Ltd.,
5. Morris, I .1986.An Introduction to the algae .Cambridge University Press, UK.
6. Parihar, N .S.1991.Bryophyta .Central Book Depot, Allahabad.
7. Bryophytes. Puri, P.1980, Atma Ram & Sons .Delhi.
8. .The Biology of Algae, Round, F .E.1986,Cambridge University Press
9. The Structure and Reproduction of The Algae F.E. Fritsch Vol I&II Vikas Publishing House Pvt. Ltd 1975.
10. Text Book of Algae O.P. Sharma .Tata McGraw Hill Publication 1986.
11. The Ecology of Algae F.E. Round Cambridge University Press.1981
12. Modern Approaches to The Taxonomy of Red and Brown Algae. Irvine and Price. Academic Press. INC 1978.
13. Algae B.S. Vashista S. Chand Co., Pvt. Ltd 1983.
14. The Blue Green Algae Fogg, Stewart, Fay & Walsby Academic Press INC 1973.
15. Text Book of Algae J.S. Gupta Oxford and IBH Publishing Co., 1981.
16. Bryophytes Vishista. S. Chand Co., Pvt. Ltd 1986.
17. Bryophytes O.P. Sharma Tata McGraw Hill Publication 2014.
18. Kumar, H.D. 1988. Introductory Phycology. Affiliated East –West Press Ltd.,
19. An Introduction to the algae. Morris, I .1986, Cambridge University Press, UK.
20. Bryophyta, Parihar, N .S.199, Central Book Depot, Allahabad.

21. Bryophytes, Puri, P.1980, Atma Ram & Sons .Delhi.
22. The Biology of Algae, Round, F .E.198, Cambridge University Press
Cambridge.

SEMESTER – II

CORE PAPER – III ECOLOGY AND PLANT GEOGRAPHY

UNIT – I

Ecology: Scope and objectives. Individual, Triggering and Holistic impacts of climatic, edaphic and biotic factors on plant life. Community concepts, Succession, migration ecesis. Methods of studying vegetation – Quadrates and transects. Population ecology, ecophene, ecotypes.

UNIT – II

Ecosystem – concept, structure, types and functions- energy flow and bio-geo chemical cycle. Ecosystem diversity – Hydric system – hydrophytic adaptations, Xeric systems – xerophytic adaptations and halophytic adaptations.

UNIT – III

Patterns in Plant biodiversity – Levels of biodiversity. Human impact on biodiversity. Distribution types – continuous, discontinuous and endemic. Conservation – Need – types (*In situ* and *Ex situ* conservation). Red data list and hotspots. Chipko movement and Silent valley project.

UNIT – IV

Social impact on plant diversity: Pollution - atmosphere, water soil, Noise and radioactive pollution - Global warming, acid rain. Pollution disasters – Bhopal gas and Chernobyl tragedies. Pesticides and its impacts; Pollution law enforcement.

UNIT – V

Plant geography and forestry: Principles of plant geography – Phytogeographical regions in India. Continental drift. Vegetation mapping, GIS. Vegetation types – Rain forest, Deciduous forest, Mangrove forest and Scrub jungle. Minor forest produce. Agroforestry and Social forestry.

PRACTICALS:

- Practice to handle the instruments for the measurement of temperature (soil, air, water), moisture (rainfall, relative humidity, soil moisture), wind (velocity and direction) and light intensity.
- To study ecological adaptations (morphological and anatomical) in plants (hydrophytes and xerophytes with two examples)
- To determine minimum area of sampling unit (quadrat, line, belt and transect) for the study of plant community.
- To prepare maps of India with respect to (i) climatic zones (ii) forest types and (iii) phytogeographical regions and comment on it.

SCIENTIFIC VISITS:

Visit to biosphere reserve, national park or a sanctuary/mangrove vegetation/Botanical Survey of India/Forest Research Institutes.

REFERENCES:

1. A text book of Plant Ecology; R.S. Shukla and P.S. Chandel. 2007, 11th Edition. C. Chand and Company Ltd. New Delhi.
2. Environmental Biology; P.D. Sharma, 1994. Rastogi and Company, Meerut.
3. Modern concepts of Ecology; H.D. Kumar, 2007. 8th Edition, UBS Publisher's & Distributors Pvt. Ltd. New Delhi.
4. Manual of Plant Ecology; K.C. Misra, 1974. Oxford & IBH Publishig Co. New Delhi.
5. Basic Principles and concepts of Ecology; Part – I. 1980. P.D.Sharma & R.Mishra.
6. The Ecology of Natural Resources; I.G.Simmons. 1986. IInd Edition, ELBS.
7. Plant Ecology; A.K. Agarwal and P.P. Deo, 2006. Agrobios (India), New Delhi.
8. Environment and Plant Ecology; J.R. Etherington, 1976.Wiley Eastern Ltd., New Delhi.
9. Ecology and Environment; P.D. Sharma, 2009. 10th Edition, Rastogi Publications, New Delhi.
10. Basic Concepts of Ecology; Clifford B. Knight, 1971. The Macmillan Company Collier – Macmillan Ltd. London.

11. Plant Ecology; Weaver and Clements, 1966. TMH Publishing Company Ltd. Delhi.
12. A text book of Plant Ecology; R.S. Ambasht and N. K. Ambasht, 2011. CBS Publishers and Distributers Pvt. Ltd., New Delhi.
13. Concepts of Ecology; R.S. Verma and V.K. Agarwal, 1998. C. Chand and Company Ltd. New Delhi.

SEMESTER II

CORE PAPER – IV PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

UNIT- I

Pteridology: General characters and classification of Pteridophytes (Sporne, 1965). A detailed study of morphology, structure, reproduction and life cycle of *Rhynia* and *Psilotum*.

UNIT- II

A detailed study of the morphology and structure of *Lepidocarpon*, *Lepidodendron*, *Stigmaria* and *Calamites*. A detailed study of the morphology, structure, reproduction and life cycle of *Lycopodium*, *Selaginella* and *Equisetum*.

UNIT- III

A detailed study of morphology, structure, reproduction and life cycle of *Adiantum* and *Marsilea*. Stellar evolution in Pteridophytes. Heterospory and seed habit.

UNIT- IV

Gymnosperms: General characters of Gymnosperms. Classification of Gymnosperms (Sporne, 1965). A detailed study of morphology, structure, reproduction and life cycle of *Williamsonia*, *Cycas*, *Pinus*, *Thuja* and *Gnetum*.

UNIT- V

Paleobotany: Geological time scale; fossils and fossilization- kinds of fossils- petrification, cast, impression and compression. Nomenclature of fossil plants. Radiocarbon dating. Contribution of Prof. Birbal Sahni (brief outline).

PRACTICALS:

Study of morphology and anatomy of the genera *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum*, *Marsilea*, *Cycas*, *Pinus*, *Thuja* and *Gnetum*.

Study of the fossil specimens *Rhynia*, *Lepidocarpon*, *Lepidodendron*, *Stigmaria*, *Calamites* and *Williamsonia*

REFERENCES:

1. Bhatnagar, S. P. and Moira, A. 1996. Gymnosperms. New age international Pvt. Ltd., New Delhi.
2. Sporne, K. R. - Morphology of Pteridophytes
3. Sharma, O. P. - Text book of Pteridophyta
4. Smith, G. M. - Cryptogamic Botany (Vol. II)
5. Vashista, P. C. - Pteridophyta
6. Vashista P. C.- Gymnosperms
7. Sporne, K. R. - Morphology of gymnosperms, 1965. Hutchinson univ. Asia Publishing House.
8. Arnold, C. A. - An Introduction to Paleobotany
9. Ganguly Dass and Dutta - College Botany
10. Narayanaswamy, K. N., Rao and Raman, A. 2000 - Outline of Botany Pteridophyta (Vascular Cryptogams)
11. P. C. Vashista, A. K. Shina, Anil Kumar, 2010,S.Chand & Company New Delhi – 110055.

SEMESTER III

SKILL BASED ELECTIVE PAPER – I BIOFERTILIZERS

Unit - I

Biofertilizers - Definition and types, importance of biofertilizers in agriculture.

Unit- II

Characteristics of Biofertilizers: Symbiotic (*Rhizobium* and Mycorrhizae), Physiological relationship of symbiosis, NIF genes concept and mechanisms.

Non Symbiotic (Phosphobacteria, *Azospirillum* and Potassium solubilizer)

Unit - III

Production technology: Sterilization, Strain selection, growth and fermentation, mass production of various Biofertilizers (*Rhizobium*) (*Azospirillum*) (Phosphobacteria) and (Potassium solubilizer)

Unit - IV

Characteristic studies and Production technology: *Azolla*, Mycorrhizae, vermicompost and traditional green manure concept.

Unit - V

Application technology: Standards and quality control, Seed and seedling treatments, soil application for both field and tree crops.

Practicals

- Demonstration of biofertilizers preparation techniques.

REFERENCES:

1. Subba Rao N S (1982). Biofertilizers in Agriculture 2nd Ed. Oxford 7 IBH Co. Pvt. Ltd.
2. Environment & soil Sciences Martin
3. Agriculture Microbiology-G Rangasamy
4. Microbiology – Michael J Peleazar, E.C.S. Chan and Noel. R. Krieg. 5th Edition 1993. Tata McGraw- Hill Edition

SEMESTER – IV

CORE PAPER – V ANATOMY, EMBRYOLOGY AND SEED TECHNOLOGY

Anatomy

Unit – I

Cell wall: ultra structure; pits and their types; plasmodesmata; functions.

Meristems: Classification; characteristics; shoot and root meristems- various theories (Apical cell theory, Histogen theory, Tunica corpus theory and Korper-Kappe theory); Cambium.

Tissues: Simple tissues – parenchyma, collenchyma, sclerenchyma; complex tissues- xylem, phloem.

Unit- II

Structure of monocot and dicot leaves; stomata and their types; hydathode and its functions. Primary structure of dicot stem and root; monocot stem and root. Nodal anatomy. Normal and anomalous secondary growth (*Nyctanthus*).

Embryology

Unit – III

Structure and development of microsporangium; microsporogenesis; microgametogenesis; pollen wall features. Scope of Palynology. Megasporangium - types of ovule, nucellus, integument, obturator, carnucle, hypostase and epistase.

Unit – IV

Megasporogenesis and megagametogenesis – monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types. Pollination types and agents. Fertilization: Double and triple fusion; Endosperm – types; Aleurone tissue. Embryogeny – dicot (*Capsella*) and monocot (*Najas*). Outlines of Polyembryony.

Unit – V

Seed Technology

Amphimixis – Scope, Aim and importance of seed technology, structure of seed and seed coat; Seed germination and factors affecting germination, Vivipary, Seed dormancy and its types; Seed dispersal – types; seed viability – Tetrazolium test; overview of seed collection, processing, storage and seed certification.

PRACTICALS:

1. Observation and identification of different types of tissues (slides).
2. Observation and study of internal structure of monocot (stem and root) and dicot (stem and root).
3. Observation and study of internal structure of monocot and dicot leaf (slides).
4. Observation and study of anomalous secondary growth in *Nyctanthus*.
5. Observation and study of nodal anatomy – unilacunar, trilacunar (slides).
6. Observation of stomatal types.
7. Observation and study of T.S of young anther.
8. Observation of ovule types (slides).
9. Observation of embryo sac structure (chart).
10. Dissection of dicot embryo (any one stage).
11. Study of endosperm types (slide).
12. Testing of seed viability –Tetrazolium salt test.

REFERENCES:

1. Anatomy of seed plants –Katherine Esau. 2nd Edition 1965 Wiley New York.
2. Esau's Plant Anatomy: Meristems, Cells, and Tissue of the Plant Body, 3rd Edition Author R. F Suan E. Eichhorn. 2006.
3. Plant Anatomy –Fahn. A. 3rd Edition 1985. Pergamon Press New York.
4. Comparative Wood Anatomy –Carlquist, S. Springer Science. Publication. 2001
5. Anatomy of Seed Plant V. Singh P.C. Pande and D.K. Jain Rastogi Publications Meerut 1998.
6. College Botany Vol II. B.P Pandey S. Chand and CO., Ltd New Delhi 2011.
7. Plant Anatomy B.P. Pandey S. Chand and Co., Ltd., New Delhi 2009.
8. Embryology of Angiosperms- S.S. Bhojwani and Bhatnagar, S, P.Vikas Publishing House Pvt Ltd., 2009
9. An Introduction to embryology of angiosperm-P. Maheswari 1963. McCraw-Hill., New York.

10. Plant Anatomy, 1996. M.S. Tayal., Rastogi Publications.

11. Principles of Seed Technology 1995. Agarwal. II nd Edition Oxford and IBH Publications Pvt. Ltd. New Delhi India.

SEMESTER-IV

SKILL BASED ELECTIVE PAPER - II MUSHROOM CULTIVATION

UNIT-I

Introduction: importance, classification and test for identification of mushrooms.
Nutritional and medicinal value of mushrooms.

UNIT-II

Morphology and characteristics of commonly cultivated edible mushrooms.

- a. Paddy straw mushroom (*Pleurotus* sp.)
- b. Button mushroom (*Agaricus bisporus*)
- c. Milky mushroom (*Calocybe indica*)

Life cycle of a common mushroom (*Agaricus*)

UNIT-III

Culture Technology: Mushroom cultivation: site selection and construction of mushroom shed, infrastructure facilities, mushroom mother stock culture by tissue culture; preparation of mother spawn and seed spawn; mass cultivation techniques for *Agaricus* and *Pleurotus* mushrooms.

UNIT- IV

Post-harvest technology: Harvesting and marketing, Preservation and storage of mushrooms. Problems in mushroom cultivation-pest and diseases, weed moulds and their control.

UNIT-V

Delicious recipes of mushrooms (mushroom soup, pickle and); Economic importance of mushroom.

PRACTICALS:

1. Spawn production
2. Sterilization of substrates
3. Bed layering and seeding
4. Observing the yield of mushrooms
5. Preparation and preservation of mushroom pickle

REFERENCES:**TEXT BOOK:**

1. Nita Bahl (1996), Handbook of mushrooms. Oxford and IBH publishing co.Ltd. New Delhi.
2. Kapoor, J.N. (1989) Mushroom cultivation, ICAR, New Delhi.

REFERENCE BOOKS:

1. Aneja, K.R. 1993. Experiments in microbiology, Plant pathology, Tissue culture and Mushroom cultivation. Wishwa Prakshan, Ne

SEMESTER-V

CORE PAPER-VI CELL AND MOLECULAR BIOLOGY

UNIT-I

Cell Biology: The cell-Historical background; cell theory; Structure of the plant cell; chemical foundation; comparative account of prokaryotic and eukaryotic cell.

Plasma membrane – Structure, model and functions; Chloroplast – Structure and function and its significances.

UNIT-II

Mitochondria – Structure and functions; Nucleus – Structure; nuclear pores; nucleosome organization; Chromatin; Karyotypes; special type of chromosomes – Giant and lamp brush chromosomes. Ribosomes – Origin; Structure; site of protein synthesis

UNIT-III

Other cellular organelles – Structure and functions of Golgi apparatus, lysosomes, endoplasmic reticulum; dictyosomes, peroxysomes. Cell division and cell cycle – Mitosis and meiosis – significance; various stages of cell division progression; cytokinesis; cell cycle.

UNIT – IV

Knowledge on nucleic acids – DNA and RNA (structure and types only)

Gene expression and the Central Dogma, **Transcription**: RNA polymerase, mechanism of initiation, elongation and termination in *E. coli*. Post-transcriptional processing, spliceosomes. **Translation** – organization of mRNA, amino acyl synthetase, tRNA and amino acid activation. Mechanism of initiation elongation and termination. Translation factors, post-translation processing.

UNIT - V

Regulation of gene expression: The principles, cooperative and on off regulations. Molecular mechanism: Negative and positive, repressors and inducers. Mechanism of *Lac* and *trp* operon in *E.coli*. Brief outline of eukaryotic gene regulation.

PRACTICALS.

- Observation and study of ultrastructure of cell organelles (chart, slides, models & micrographs).
- Observation of different stages of mitosis in onion root tip squash preparation.
- Micrographics of cell organelles (only schematic representations)
- Observation of the Scheme/ Photograph of Structure of DNA, t-RNA, and mRNA, Transcription, Translation, 'Lac' operon, 'Trp' operon

REFERENCES:

1. Freifelder, D. 1993. Essentials of Molecular Biology, Jones & Bartlett, Boston.
2. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
3. Elliott WH & Elliott, DC. 2005. Biochemistry and Molecular Biology, 3rd Ed. Oxford University, Oxford.
4. Watson, J.D. 1987. Molecular Biology of Gene. The Benjamin. Gummings publishing co. inc. California
5. Hopkins, W. 1988. Molecular biology of the gene. Benjamin publishing Company. California.
6. Geoffrey m. Cooper, Robert, E. Hansman. 2007. The cell- A Molecular approach, sinauer Associates. USA.
7. Lee, P. J. 1999. Plant Biochemistry and Molecular Biology, 2nd edition. John Wiley and Sons, New York.
8. Gupta, P. K. 1999. A Text – book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
9. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular cell biology (4th Edition). W.H. Freeman and Co. New York, USA.

SEMESTER – V

CORE PAPER-VII PLANT SYSTEMATICS AND ECONOMIC BOTANY

Unit – I

Plant morphology: Leaves, Stem, Root, Inflorescence, Flowers and Fruits. Classification of Angiosperms-Bentham and Hooker system. Floristic studies: Flora, revision and Monographs.

Unit – II

Botanical nomenclature (ICN), Brief history of congresses, Taxonomic hierarchy, typification, principles of priority, publication, Keys and their types, preparation of dichotomous key, Preparation and role of Herbarium.

Unit – III

Systematics, phylogeny and economic importance of the following families: Magnoliaceae, Tiliaceae, Meliaceae, Anacardiaceae, Rosaceae, Apiaceae, Rubiaceae and Asteraceae.

Unit – IV

Systematics, phylogeny and economic importance of the following families: Sapotaceae, Apocynaceae, Lamiaceae, Amaranthaceae, Casuarinaceae, Amaryllidaceae, Liliaceae, Araceae and Poaceae.

Unit – V

Economic importance: Binomials, Family, Morphology of useful parts and uses of the following commercially important plants. Cereal (paddy). Timber (Teak), Pulse (Green gram), Oil yielding plant (coconut), Spices (*Cinnamomum*), Fiber (Cotton), Beverage (Coffee). Medicinal Plant (*Phyllanthus amarus*). Ethnobotany with special reference to Indian systems of medicine.

PRACTICALS:

Diversity of Angiosperms: Morphology of Angiospermic plants.

Taxonomy: Taxonomic study of plants belonging to the families as per the syllabus (only dicot families given for identification in practical examinations).

Field visits: Botanical study tour for 3 or 4 days to be undertaken for covering various natural habitats and one or two single day collection trips.

Submission herbarium: Submission of 20 herbarium sheets along with tour/trip report and field note book.

Economic Botany: Study of the morphology and structure of useful parts of the plants mentioned in and herbarium sheets and collection of samples of plants.

Ethnobotany: Listing of the medicinal practices of one or two tribes.

REFERENCES:

1. Plant Taxonomy O.P. Sharma.2007 Data McGraw-Hill Publishing Company New Delhi.
2. Introduction to Taxonomy of Angiosperms 2011 B.K. Verma PHI Learning Pvt. Ltd New Delhi.
3. Taxonomy of Angiosperms V. Singh, Dr. V. Singh & Dr. D.K. Jain Second Edition 2010. Rastogi Publications Meerut India.
4. Plant Systematics 2004. Singh Oxford & IBH Publishing Co., Pvt., Ltd. New Delhi.
5. Advanced plant Taxonomy A.K. Mondal. New Central Agency Pvt. Ltd., 2009. New Delhi.
6. College Botany Vol. I. B.P. Pandey. S. Chand and Co., Ltd. New Delhi. 2011
7. Systematic Botany Bharathi Bhattacharyya 2009. Narosa Publishing House. India.
8. Modern Plant Taxonomy Dr. N.S. Subrahmanyam Vikas Publishing House Pvt. Ltd New Delhi
9. Economic Botany – Pandey, B.P. and Anita. S. Chand and Co., Ltd. New Delhi. 2009.
10. Economic Botany of the Tropics – Kochar, S.L. (2000). Macmillan India Pvt. Ltd.
11. The useful Plants of India – CSIR Publications (1986) and Information Directorate, New Delhi.
12. Economic Botany – Sharma (1996) Tata McGraw Hill Co., Ltd.

SEMESTER-V

CORE PAPER-VIII GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS

UNIT –I

Mendel's Experiments and Principles of inheritance, Law of Segregation, Law of Independent assortment, Law of Dominance, back cross and test cross; Gene interaction: Allelic interaction (Incomplete dominance), Non allelic interaction (Dominant epistasis); Linkage and crossing over (Brief outline only).

UNIT-II

Mutation (Spontaneous and induced mutations), Physical and chemical mutagens, Molecular basis of mutation; Replication of DNA (Semi conservative model); Genetic code; Structure of gene (Split gene); Brief outline of Chromosomal aberrations.

UNIT-III

Extra-Chromosomal inheritance: Cytoplasmic male sterility (eg., *Acetabularia*) and Plastid inheritance (*Mirabilis*); Sex determination ; Population Genetics: Gene frequency, Hardy- Weinberg's Law, Factors affecting Hardy- Weinberg Equilibrium.

UNIT-IV

Plant Breeding and Evolution: Selection (Mass and Pure line selection), Hybridization and heterosis in crop improvement. Origin of Life, Evidences for organic evolution; Theories of organic evolution (Darwinism & Mutation Theory).

UNIT-V

Biostatistics: General concepts and Terminology, Data-types (Primary and Secondary Data), Data collection, Sampling methods, Frequency distribution, Tabulation-General rules for Tabulation, Parts of Tables and Types of Tables, Diagrammatic and Graphic representation of Data. Analysis of Data-Measures of Central tendency (Mean, Median and Mode), Measures of Dispersion (Range, Standard Deviation and Standard Error), Test of Significance: Chi-square test.

PRACTICALS :

Biostatistics:

- Data analysis to determine Mean & Mode
- Finding out Standard Deviation by giving Data from plant sources
- Chi-square test

Genetics & Plant breeding:

- Chromosomal mapping
- Simple problems on the following aspects: Monohybrid cross, Test cross, Incomplete dominance and Dominant epistasis.
- Hybridization techniques using potted plants.

REFERENCE BOOKS:

1. Principles of Genetics – Eighth edition - Gardner, Simmons and Snustad (1991) John Wiley & Sons, Inc., Newyork.
2. Cytogenetics, Evolution and Plant Breeding- R.S. SHUKLA and P.S.CHANDEL (1988) S.Chand & Company (Pvt) Ltd, New Delhi.
3. A Textbook of Cytology, Genetics and Evolution-Third edition -P.K. GUPTA (1979) Rastogi Publications, Meerut, India.
4. Fundamentals of Cytogenetics and Genetics- Mahabal Ram (2010) PHI Learning Private Limited, New Delhi.
5. Genetics: Classical to Modern-First Edition- P.K.Gupta, (2007) Rastogi Publications, Meerut , India.
6. Principles of Genetics- S.B. Basu M. Hossain (2006), Books & Allied (P) Ltd, Kolkata.
7. Introduction to Biostatistics and Research Methods- Fourth Edition- P.S.S. Sundar Rao J.Richard, (2004) Prentice-Hall of India, New Delhi.
8. Fundamentals of Biostatistics- First Edition- Irfan A. Khan & Atiya Khanum, (1994) Ukaaz Publications, Hyderabad, Andhra Pradesh, India.
9. Organic Evolution -12th Revised Edition- Dr. Veer Bala Rastogi (2007) Kedar Nath Ram Nath, Meerut, New Delhi.

10. Biostatistics: Principles and Practice - B. Antonisamy, Solomon Christopher and P. Prasanna Samuel (2010) Tata McGraw Hill Education Private Limited, New Delhi.
11. Principles and Practice of Plant Breeding- J R Sharma (1994) Tata McGraw Hill Publishing Company Limited, New Delhi.
12. Principles of Biostatistics – Second Edition -Marcello Pagano, Kimberlee Gauvreau (2008) Cengage Learning India Private Limited, New Delhi.
13. Origin, Evolution and Adaptation- Sanjib Chattopadhyay (2007) Books and Allied (P) Ltd, Calcutta.
14. Essential Genetics - Second Edition- Peter J Russell (1987) Blackwell Scientific Publications, London.
15. Cytogenetics ,Evolution, Biostatistics and Plant Breeding - First Edition – R.A Shukla and P.S Chandel (2009) S.Chand & Company Ltd, New Delhi.

SEMESTER –V

SKILL BASED ELECTIVE PAPER – III HORTICULTURE

Unit – I

Horticulture – Definition, branches and importance, Media – vermiculite, compost and soil mixture. Growing structures- pots and green house; Organic manure: farmyard and vermicompost, Inorganic fertilizers: Urea, Potash and Superphosphate.

Unit –II Gardening – Landscape gardening, Lawn, Rockery, Bonsai, Water garden, cut flowers (Only examples), and Ikabana.

Unit –III

Irrigation – Basic drip irrigation, Training – central leader and Kiffin system. Mulching, Pruning – Notching, disbudding and thinning cutting – root, soft wood and leaf cutting. Layering – simple, mound and air layering. Grafting – approach and tongue grafting. Budding –‘T’ budding and ring budding.

Unit –IV

Pomology – Cultivation of Mango. Floriculture – Cultivation of Rose, Olericulture – Cultivation of brinjal

Unit –V

Plant Production and storage: Cultural and mechanical methods, uses of insecticide. Harvesting, Grading, and Packing. Storage – Refrigerated storage, controlled atmosphere storage (CAS).

PRACTICALS:

- Learning the methods of macro propagation, techniques of layering, different methods of cutting and grafting. Field trips to established Botanical gardens.

REFERENCES:

1. Ornamental Horticulture – Vishnu Sworup
2. Introduction to Horticulture – Kumar. N
3. Home Gardening – Trivedi
4. Horticulture – Manibhussan Rao
5. Fundamentals of Horticulture – Hatmann and Kestr.

SEMESTER VI

PAPER-IX: PLANT PHYSIOLOGY

Unit - I

Plant-Water relations: Importance of water; diffusion and osmosis; absorption; Transport of water and transpiration; physiology of stomatal movement; Membrane transport and translocation of water and solutes – Mechanism of water transport through xylem. Passive and active solute transport; phloem loading and unloading; Mechanism of phloem transport; source –sink relationship; factors affecting translocation.

Unit-II

Photosynthesis: historical aspects; photosynthetic pigments, action spectra and enhancement effects; concept of two photosystems; Z–scheme: photophosphorylation; Calvin cycle; C4 pathway, CAM plants.

Unit-III

Respiration - ATP - the biological energy currency; aerobic and anaerobic respiration; Glycolysis, Krebs' cycle; electron transport mechanism; oxidative phosphorylation; pentose phosphate pathway.

Unit-IV

Mineral nutrition: Essential micro and macro elements and their role, mineral uptake, deficiency and toxicity symptoms. Nitrogen metabolism and growth: Biology of nitrogen fixation; importance of nitrate reductase and its regulation; ammonium assimilation;

Unit-V

Different phases of growth and development; plant movements (tactic and tropic); the concept of photoperiodism. Physiology of flowering: florigen concept: vernalization, biological clocks: physiology of senescence, fruit ripening; Plant hormones- Auxins, Gibberellins, Cytokinins, Abscisic acid and Ethylene, Photomorphogenesis: cytochromes and phytochromes.

PRACTICALS:

1. Determination of osmotic pressure.
2. Factors affecting permeability of membrane.
3. Determination of rate of transpiration,
4. Separation of chloroplast pigments by paper chromatography.
5. Determination of rate of photosynthesis under variable CO₂ concentrations.
6. Determination of rate of photosynthesis under various light intensities.
7. Measurement of respiration (Ganong's respiroscope).
8. Determination of water absorption/transpiration ratio.

REFERENCES:

1. Hopkins, W.G (1995) Introduction to Plant Physiology. John Wiley & Sons Inc. New York, USA.
2. Salisbury, F.B and Ross, C.W. 1992. Plant Physiology (4th Edition) Wadsworth Publishing Co. California, USA.
3. Devlin and Witham, F.H. 1999. Plant Physiology. 4th Edition, CBS Publishers and Distributors, New Delhi.
4. Noggle, G.R. and Fritz, G.J. 2010. Introductory Plant Physiology. 2nd Prentice Hall of India, New Delhi.
5. Kochhar, P.L and Krishnamurthy, H.N. 1989. Plant Physiology. Atmaram & Sons, New Delhi.
6. Jain, V.K. 1995. Fundamentals of Plant Physiology. S. Chand & Co. New Delhi.
7. Verma, S.K. 1995. A Textbook of Plant Physiology and Biochemistry. Chand & Company Ltd, New Delhi.
8. Mukherji S and A.K. Ghosh. 1996. Plant Physiology. Tata McGraw Hill Publishing Company Ltd, New Delhi.
9. Subhash Chandra Datta. 1994. Plant Physiology. Wiley Eastern Ltd, New Delhi.
10. Sinha, R.K. -2007, Modern Plant Physiology, Narosa Publishing House, New Delhi.

SEMESTER – V

CORE PAPER – X PLANT BIOCHEMISTRY

Unit- I

Cellular Chemistry: Covalent and non-covalent interactions; hydrogen bond; electrostatic interactions; hydrophobic interactions; Van der Waals forces and their significance; structure and properties of water and its biological significances.

Unit - II

pH and buffers: pH and its significance; pH scale; Henderson-Hasselbach equation; isoelectric point; buffers (inorganic and organic) and their importance; ATP – the energy currency;

Energy flow: Laws of thermodynamics; concept of free energy; energy transfer and redox potential.

Unit – III

Enzymes: Structure, nomenclature, Modern classification and mechanism of enzyme action, factors affecting enzyme activity.

Carbohydrates: Classification (brief outline), structure of glucose, sucrose, starch and cellulose.

Unit – IV

Amino acid and Proteins: Structure and classification of amino acids; peptide bond; polypeptide chain; structure of proteins – primary, secondary, tertiary and quaternary.

Lipids: Classification (brief outline), difference between saturated and unsaturated fatty acids; fatty acid biosynthesis and β – oxidation of fatty acids.

Unit – V

Nucleic Acids: Molecular composition of DNA; Watson and Crick model of DNA structure; A, B and Z forms of DNA; denaturation and renaturation of DNA, RNA types (tRNA, rRNA and mRNA).

Vitamins: General properties and classification of vitamins.

PRACTICALS:

1. Preparation of buffers – phosphate and citrate buffer
2. Determination of pH of any two soil samples
3. Determination of pH of lemon and watermelon
4. Qualitative test for carbohydrates, amino acid and proteins.
5. Separation of amino acids by paper chromatography
6. Estimation of carbohydrate by colorimetric method (Anthrone reagent method)
7. Estimation of total free amino acids by ninhydrin reagent method
8. Estimation of total protein by Bradford reagent method.

REFERENCES:

1. Conn, E. & Stumpf, P.K., 1979. Outline of Biochemistry, Niley Easdtern Ltd., New Delhi.
2. Stryer, L. 1995. Biochemistry, Fourth edition. W.H. Free Man & Company New York.
3. Lehninger, A.L. 2005. Biochemistry V edition, Kalyani Publishers, Ludhiana.
4. Jain, J.L., 1999. Fundamentals of Biochemistry. S.Chand & Co. Ltd., New Delhi.
5. Nelson, D.L. and Cox, M.M. 2000. Lehninger – Principles of Biochemistry. Worth Publishers, New York.
6. Devlin TM. (ed.), 2006. Text book of Biochemistry, 6th Ed. A John Wiley & Sons, Inc. Publication, New York.
7. Wilson, K. and Walker, J. 2000. Practical Biochem- Principles and Techniques. Cambridge Uni. Press, Cambridge, U.K.
8. Das Gupta, S.K. 1977. Biochemistry Vol.II, Macmillan & Co., New Delhi.
9. Berg JM, Tymoczko JL & L Stryer. 2006. Biochemistry, 6th edition, W.H. Freeman and Company, New York.
10. Elliott WH & Elliott DC. 2005. Biochemistry and Molecular Biology, 3rd Ed. Oxford University, Oxford.
11. Metz, E.T., 1960. Elements of Biochemistry, V.F & S (P) Ltd., Bombay.

12. Renganatha Rao, K., 1986. Text Book of Biochemistry, Prentice-Hall of India (P) Ltd., New Delhi.
13. Saim, A.S., 1994. Text Book of Biochemistry, CBS Publishers, New Delhi.
14. Zubay, G.L., Pason, W.W. and Vane, D.E. 1995. Principles of Biochemistry W.W.C Brown Publishers, Oxford.
15. Lea, P.J and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology, 2nd Ed. John Wiley and Sons Ltd. England.
16. Weil, J. H. 1997. General Biochemistry. New Age International Ltd., New Delhi.
17. Voet, D and Voet, J.H. 1995. Biochemistry. John Wiley and Sons, New York.
18. Marry.K.Campbell. Shawn O. Fawell. 2007. Biochemistry. 6th Ed. Thompson.Brooks/cole.USA
19. Reginald.H.Garrett,Charles M. Grisham. 2010. Biochemistry. Mary Fimch Publisher. Boston. USA.
20. McKee and J.R. McKee, 1996. Biochemistry and introduction. Won C. Brown publishers, London.

SEMESTER VI

CORE PAPER XI: BIOTECHNOLOGY AND BIOINFORMATICS

Unit I

Biotechnology: basic concepts, Principles, scope and classification of Biotechnology; Enzymes in molecular cloning, gene constructs, Gene library and cloning vectors. Gene cloning - principles and techniques.

Unit II

Molecular biology of gene transfer system: Natural mode of gene transfers – Transformation, Transduction, Conjugation and Transposition. DNA chip technology and its potential; DNA probes and blotting techniques: Western, Southern and Northern techniques.

Unit III

Genetic Engineering: Fundamentals of recombinant DNA technology- aim and scope for developing transgenic plant – Bt cotton, golden rice, variegated banana. *Agrobacterium* mediated gene transfer techniques to develop disease resistant and stress tolerant plants; Pros and cons of GM crops.

Unit IV

Bioinformatics: Fundamentals of computer, hardware components, software types- operating system software (Windows and UNIX) and programme software (BioPEARL and BioJAVA), Networks – LAN, WAN, Internet-browsing software, HTML, Databases, Data mining and Data retrieval.

Unit V

Functional genomics: DNA sequence databases (GenBank and DDBJ), Sequence alignment (Pair wise and multiple sequence) phylogenetic analysis. BLAST implications, Gene identification and prediction. Proteomics: Protein sequence databases (SWISS PROT and PDB), Protein visualization tools (Rasmol and Pymol) - Protein structure prediction - Homology modeling of protein (Swiss pdb Viewer) - Brief outline of computer Aided Drug Designing.

PRACTICALS:

Isolation of DNA from bacteria (Demonstration)

Isolation of DNA from plant tissue (Demonstration)

Amplification of DNA through PCR (Demonstration)

Windows and UNIX operating system.

Content and file structure study of GenBank, DDBJ, PDB, SWISSPROT.

Multiple sequence alignment using Clustal X and phylogenetic tree construction.

Molecular visualization using Rasmol.

REFERENCES:

1. Bioinformatics: Methods and applications – S. C Rastogi, N. Mandiratta and P, Rastogi, PHI New Delhi.
2. Bioinformatics: Principles and applications – Z. Ghosh and B. Mallick, OUP, New Delhi
3. Elements of Biotechnology – P. K. Gupta, Rastogi publications, Meerut
4. Biotechnology – Sathyanarayana, NCB, Calcutta.

SEMESTER –VI

SKILL BASED ELECTIVE PAPER – IV PLANT TISSUE CULTURE

Unit – I

Introductory History, Laboratory organization, Culture Media (MS medium), Aseptic Techniques.

Unit –II

Micropropagation – Direct and Indirect (Callus culture, Nodal culture, Meristem culture, Shoot tip culture), Somaclonal variation, Suspension culture.

Unit –III

Haploid culture – Anther culture, pollen culture and ovary culture - Triploid production.

Unit –IV

Isolation and culture of protoplast, Somatic Hybridization, Somatic Embryogenesis, Artificial seed production.

Unit –V

Production of secondary metabolites – alkaloids, steroids, and terpenoids (Brief account only). Cryopreservation and germplasm preservation.

PRACTICALS:

1. Sterilization techniques (Fumigation, Flame sterilization, Dry heat, Wet heat and Filter sterilization)
2. MS Medium preparation
3. Callus culture
4. Nodal culture
5. Artificial Seed production

REFERENCES:

1. Plant Cell and Tissue Culture – Narayanasamy, S. Tata Mc- Graw- Hill Publishing & Co Ltd

2. Plant Cell, Tissue and Organ Culture – Edited by J. Renert and Y.P.S.Bajaj, Narosa Publishing House New Delhi First Reprint 1989.
3. An Introduction to Plant Tissue Culture – Razdan, M.K.
4. Biotechnology- U Sathyanarayana Books and Allied (P) Ltd, (2005).
5. Text Book of Biotechnology – Dubey. R .C S. Chand &Co New Delhi, First Edition 1993.
6. Biotechnology – Kumaresan, V.
7. Concept of Biotechnology - Balasubramanian *et al.* University Press.
8. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom production, Aneja. K.P. (2001), New Age International (P) Ltd. New Delhi.
9. Elements of Biotechnology – P.K Gupta. Rastogi Publication (Revised Second Edition 2009-2010), New Delhi.
10. A Laboratory Manual Plant Biotechnology – S.S.Purohit (2006), Agrobios (India), Jodhpur.
11. Plant Biotechnology Practical Manual- C.C.Giri and Archana Giri (2007), I.K. International Publishing House Pvt. Ltd. New Delhi.

Non Major Elective
PLANTS AND HUMAN WELFARE - I
(OUTLINE ONLY)

UNIT I

Origin of Life – Abiogenesis - Miller-Urey Experiment. Theories of Evolution- Darwin (Natural Selection) and Lamarck (Use and disuse, Inheritance of acquired traits). The Cell - basic unit of Life, Difference between Plant and Animal cell. Classification of Living organism (Whittaker's Five Kingdom Concept).

UNIT 2

Morphology of typical dicot plant- Plant conservation: *in situ*, *ex situ*, Plant tissue culture- Micropropagation (nodal and callus culture).

UNIT 3

Elements and compounds - Acid, Base and salt. Carbohydrate, Protein, Lipid and Nucleic acid.

UNIT 4

ATP and its significance, Photosynthesis. Respiration. Nitrogen Cycle.

UNIT 5

Mendalism- Monohybrid, dihybrid cross. Central dogma of molecular biology. Watson and Crick model of DNA structure. Significance of green and white Biotechnology; rDNA Technology: Bt Cotton, Glowing tobacco, Human Insulin.

REFERENCES:

1. Fundamentals of Biochemistry, J.L. Jain, Smjay Jain and Nitin Jain, S.C. Land, Reprint Edn. 2007 (7 September 2004).
2. Biochemistry - Dr. U. Sthyanarayana and Dr. U. Chakrapani, Elsevier; Fourth Edition 1, June 2013.

3. Fundamentals of Plant Physiology, V.K. Jain S. Chand & Co Ltd, 5th Revised Edition, 31 October 2000
4. Environmental Studies (UGC Syllabus) 2014N. Arumugam and V. Kumaresan, Saras Publication 2 edition 2014
5. Cell Biology, Genetics, Evolution and Ecology, P.S. Verma, S. Chand, Reprint Edn 2006 edition (1 September 2004)
6. Economic Botany January 1999, B.P. Pandey, S. Chand & Co Ltd, 5th Revised edition 1 January 1999.
7. Websites
<http://www.wikipedia.org>
<http://www.britannica.com>
<http://www.eol.org>
8. Introduction to Horticulture, N. Kumar, Oxibh, 2010
9. A text book of Biotechnology, R. C. Dubey, S. Chand; 4th Rev. Edn 2006 edition (1 December 2007).
10. Mushroom Cultivation and Uses, B.C. Sharma and Suman, Agrobios (India) 2005.

Non Major Elective
PLANTS AND HUMAN WELFARE -II
(OUTLINE ONLY)

UNIT 1

Sustainable livelihood. Plants: Definition and Plantae. Importance of Plants-Food, Non-food products, Aesthetic, Scientific and cultural uses and Negative effects. Plants in Space.

Unit 2

Kitchen Garden, Roof Garden, Ornamental Garden and Lawn making, Bonsai, Floral arrangement: Vase, Bouquet and Back drop.

Unit 3

Organic farming – Advantages, Organic manure, Farm yard manure and green manure. Vermicompost. Bioinoculants - Blue Green Algae, *Azolla* and *Azospirillum*.

Unit 4

Nutritional value of Mushrooms, Common edible Mushrooms, Mushroom culture (Schematic diagram).

Unit 5

Economic Botany of plants yielding Wood (Teak wood and Rose wood), Fibre (Cotton and Jute), Oil (Sun flower and Ground nut) and Medicine (Tulsi and Keelanelli).

REFERENCES:

1. Fundamentals of Biochemistry, J.L. Jain, Smjay Jain and Nitin Jain, S.C. Land, Reprint Edn. 2007 (7 September 2004).
2. Biochemistry - Dr. U. Sthyanarayana and Dr. U. Chakrapani, Elsevier; Fourth Edition 1, June 2013.

3. Fundamentals of Plant Physiology, V.K. Jain S. Chand & Co Ltd, 5th Revised Edition, 31 October 2000
4. Environmental Studies (UGC Syllabus) 2014N. Arumugam and V. Kumaresan, Saras Publication 2 edition 2014
5. Cell Biology, Genetics, Evolution and Ecology, P.S. Verma, S. Chand, Reprint Edn 2006 edition (1 September 2004)
6. Economic Botany January 1999, B.P. Pandey, S. Chand & Co Ltd, 5th Revised edition 1 January 1999.
7. Websites
<http://www.wikipedia.org>
<http://www.britannica.com>
<http://www.eol.org>
8. Introduction to Horticulture, N. Kumar, Oxibh, 2010
9. A text book of Biotechnology, R. C. Dubey, S. Chand; 4th Rev. Edn 2006 edition (1 December 2007).
10. Mushroom Cultivation and Uses, B.C. Sharma and Suman, Agrobios (India) 2005.

SEMESTER – I

ALLIED PAPER - I GENERAL BOTANY - PLANT DIVERSITY

(For B. Sc. Zoology Students)

Unit -I

A general classification of plant Kingdom. A general outline of Viruses and Bacteria. Algae - Structure and life history of the following genera: *Chlamydomonas*, *Chara*, *Dictyota* and *Polysiphonia*.

Unit - II

Fungi - Structure and life history of the following genera - *Albugo*, *Saccharomyces* and *Puccinia*; Bryophytes - Structure and life history of *Riccia* and *Polytrichum*.

Unit - III

Pteridophytes - Structure and life history of the following genera: *Lycopodium*, *Adiantum*; Gymnosperms - Structure and life history of *Cycas*.

Unit - IV

Developmental Biology - Parts of a flower; pollination mechanism; classification of fruits and seeds. Dispersal of fruits and seeds. Seed germination - Epigeal (Bean) and Hypogeal germination (Paddy) and Vivipary (*Rhizophora*).

Unit - V

Taxonomy – Binomial system, Outlines of classification of Bentham and Hooker's system; Taxonomic features, and economic importance of the following families; Annonaceae, Rutaceae, Cucurbitaceae, Apiaceae, Asclepiadaceae, Acanthaceae, Amaranthaceae and Poaceae.

PRACTICALS:

- Morphological and anatomical features of Bacteria, Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- Morphology of fruits and seeds. Fruit and seed structures for dispersal. Types of germination in dicot and monocot seeds.

- Taxonomy of locally available plants belonging to the families mentioned in the syllabus.

REFERENCES:

A text book of ancillary Botany – Muneeswaran.

Outlines of Botany – Narayanasamy and K.N.Rao.

Botany for Degree students – Dutta.A.C

College Botany – Gangulee.

SEMESTER – II

ALLIED PAPER - II PLANT STRUCTURE AND FUNCTIONS

(For B. Sc. Zoology students)

Unit - I

Cytology - Ultra structure of plant cell. Structure and functions of mitochondria, chloroplast and nucleus. Anatomy - Simple and complex tissues; Anatomy of stem, leaf and root of dicot and monocot plants: Secondary growth in dicot stem and root.

Unit - II

Embryology - Structure of mature anther and ovule. Fertilization (double fertilization and triple fusion). Structure, types and functions of endosperm. Structure of a mature dicot embryo. Genetics - Mendelism - Monohybrid and Dihybrid ratios - Laws of dominance, Segregation and Independent assortment.

Unit - III

Plant physiology - Water absorption. Types of transpiration. Mechanism of stomatal transpiration. Photosynthesis: Light reaction and dark reaction (C_3 & C_4 Cycle). Respiration: Glycolysis, Krebs's cycle and electron transport, Growth (Growth curve and Auxins) and plant movements (phototropism and geotropism).

Unit - IV

Plant Breeding: Aim, Scope and Significance. Selection, Hybridization and Heterosis (Outline only) Plant Biotechnology - Aim, Scope and Significance.

Unit - V

Ecology - Factors of Environment (Abiotic and Biotic Factors), Morphological and Anatomical adaptations of Xerophytes (*Nerium*) and Hydrophytes (*Hydrilla*). Pollution (Air, Soil and Water) and its control.

PRACTICALS:

Embryology: Structure of mature Anther, Ovule and dicot embryo.

Anatomy: A study of T.S of Young stem (Bean and Maize), Root (Bean and Canna) and leaf (Sunflower and Grass); Normal secondary structures of dicot stem and root (*Polyalthia, Ricinus*)

Physiology: Experiments to demonstrate the physiological activities mentioned the syllabus.

Ecology: Hydrophytes and Xerophytes.

Genetics: Mono and Di-hybrid crosses.

Biotechnology: BT cotton, golden rice.

REFERENCES:

A text book of ancillary Botany – Muneeswaran.

Outlines of Botany – Narayanasamy and K.N.Rao.

Botany for Degree students – Dutta.A.C

College Botany – Gangulee.