GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG

M.Sc. – BOTANY SEMESTER – I
PAPER – I (Course Code- MBO101)

CELL BIOLOGY

Max. M. 80 **Min. M. 16**

UNIT - I

- The dynamic cells, Structural organization of the plant cell, specialized plant cell type chemical foundation, biochemical energetics.
- **Cell wall**: Structure, functions, biogenesis, growth.
- **Plasma membrane**: structure, models, functions, Ion carriers, channels and pumps, receptors.

UNIT - II

- **Chloroplast**: Structure, functions, genome organization.
- **Mitochondria**: Structure, genome organization, biogenesis.
- **Ribosome**: Structure and functions.
- **Plant Vacuole**: Structure, Functions.

UNIT - III

- **Nucleus**: Structure, nuclear envelope, nuclear pore complex, nucleolus.
- **Cell cycle**: Control mechanisms, role of cyclin and cyclin dependent kinases.
- Retinoblastoma and E2F proteins
- **Apoptosis**: Programmed cell death, Mechanism.

UNIT - IV

- **Cell shape and motility:** The cytoskeleton; organization, role of microtubules, microfilaments; motor protein; implications in cilia, flagella and chromosome movement.
- **Other cellular organelles**: Structure and functions of Lysosome, Peroxysome, Golgi apparatus, Endoplasmic reticulum.
- **Techniques in cell biology:***in situ* hybridization to locate transcripts in cell types FISH, GISH, Flow cytometry.

Laboratory Exercise

- Smear of root tips showing different stages of mitosis. {Onion,Garlic}
- Smear of anther showing different stages of meiosis. {Onion,Tradescantia}
- To study the effect of colchicines on mitosis cell division. {Onion root tip}
- Study of mitotic index from suitable plant materials.

Recommended Books:-

- Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylarand Francis) New York Group (wt)
- Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular Biology of Plant. American Society of Plant Physiologist, Maryland, USA.
- Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).
- De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.
- Gupta P.K Cell and Molecular biology Rastogi Publications.
- Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- LodishEtal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
- Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)
M.Sc. – BOTANY SEMESTER – I
PAPER – II (Course Code- MBO102)

MICROBIOLOGY, PHYCOLOGY AND MYCOLOGY

Max. M. 80 **Min. M. 16**

UNIT-I

A. Microbes

- Characteristics, structure and replication of viruses
- Structure, nutrition and genetic recombination of Bacteria
- General account of Mycoplasma.

B. Phycology -I

- General characters of Algae including diversified habitat, range of vegetative structure and reproduction.
- Classification of algae giving emphasis on pigment composition, flagellation, cell wall composition and reserve food material.

UNIT-II

Phycology -II

General account of -

a. Cyanophyceae
b. Chlorophyceae (Pandorina, Cladophora, Drapernaldiopsis)
c. Charophyceae (Chara)
d. Xanthophyceae (Botridium)
e. Bacillariophyceae (Pinnularia)
f. Phaeophyceae (Fucus)
g. Rhodophyceae (Batrachospermum)

- Economic importance with special reference to biofertilizers.

UNIT- III

Mycology - I

- General characteristics of fungi including its morphology, cellular structure and nutrition.
- Reproduction in fungi
- Heterothallism and Parasexuality
- Ainsworth system of fungal classification.
- General symptoms of plant disease.

UNIT - IV

Mycology -II

Brief life cycle of -

a. Myxomycotina (*Dictostelium*) b. Mastigomycotina (*Achlya*)
c. Zygomycotina (*Cunnighamella*) d. Ascomycotina (*Penicillium*, *Phyllactinia*)
e. Basidiomycotina (Rust- *Uromyces*, Smut - *Ustilago*)
f. Deuteromycotina (*Alternaria*, *Fusarium*)

- Economic importance, Mushroom cultivation.

Laboratory Exercise

- ❖ Bacterial staining and identification.
- ❖ Preparation of temporary mount and identification of algal material.
- ❖ Symptomlogy of some diseased specimens.
- ❖ Preparation of temporary mount and identification of fungal material.

Recommended Books

- ➢ A Textbook of Microbiology by S. S. Purohit.
- ➢ A Textbook of Microbiology by R. C. Dubey and D. K. Maheshwari.
- ➢ Microbiology, Vol. I and II by C. B. Powar and Daginawala.
- ➢ Algae by B. R. Vashishta.
- ➢ Algae by H. O. Kumar.
- ➢ Algae by Chapman.
- ➢ Structure and Reproduction of AlgaeVol.I and II by F. E. Fritsch.
- ➢ Cryptogamic Botany, Vol I by G. M. Smith.
- ➢ Introduction to Mycology by C. J. Alexopoulos.
- ➢ Mycology by Malothra and Aneja.
- ➢ An Introduction to Fungi by H. C. Dube.

Govt. V.Y.T PG. Autonomous College Durg (C.G)
M.Sc. – BOTANY SEMESTER – 1
Paper –III (Course Code- MBO103)

Biology and Diversity of Bryophyta, Pteridophyta and Gymnosperm

M.M – 80 **Min – 16**

Unit – I

- General characters, classification, distribution and, Ecological significance of Bryophytes. Fossil bryophytes.
- General account including morphology, anatomy, reproduction and interrelationship of the following groups.
    - Marchantiales – *Plagiochasma*
    - Jungermanniales –*Porella*
    - Anthocerotales{eg.*Anthoceros}*
    - Sphagnals {eg.*Sphagnum}*
    - Polytricales {eg.*Polytrichum}*

Unit – II

- General characteristics, classification, and distributionof Pteridophyta
- Evolution of stele, heterospory and seed habit.
- General account of following fossil Pteridophytes.
    - *Asteroxylon., Lepidodendron, Calamophyton.*
- Morphology, anatomy, and reproduction of the following groups:
    - Psilopsida {living Member} - *Psilotum.*
    - Lycopsida – *Isoetes.*
    - Pteropsida- *Ophioglossum,Osmunda*

Unit- III

- General Characteristics, Diversity, Classification,Evolution & Economic importance of Gymnosperms.
- General account of Cycadeoidales (Cycadeoidea, Williamsonia), Cordiatales (Cordiates).
- Brief account of following –
    - Pteridospermales –Lyginopteridaceae (*Lyginopteris*) .
    - Medullosaceae –*(Medullosa)*.
    - Caytonaceae –*(Caytonia)*.
    - Pentoxylales *(Pentoxylon)*.

Unit-IV

- Structure and Reproduction of the following–
  - *Cycadales (Zamia,).*
  - *Coniferales (Araucaria, Cedrus).*
  - *Ephedrales (Ephedra)*
  - *Welwischiales (Welwischia)*
  - *Gnetales (Gnetum, Ginkgo bioloba).*

Laboratory Exercise

- **Monographic** study of following genera: (Bryophyta)
  - *Plagiochasma, Fimbrieria, Porella, Fossombronia, Anthoceros, Sphagnum,Funaria, Polytrichum*
- **Monographic** study of following genera (**Pteridophyta)**
  - *Psilotum, Isoetes,Equisetum, Ophioglossum, Osmunda, Marsilea*
- **Monographic** study of the following members of (Gymnosperms)
  - *Cycas, Pinus, Araucaria, Thuja, Ginkgo biloba, Ephedra, Gnetum*
  - Fossil specimen and slides.

Recommended Books:

- Sporne, K.R. An introduction to Gymnosperms
- Coutler and chamberian
- Bhatnagar, S.P. Gymnosperms
- Vashishta, P.C. Gymnosperms
- Stewart, W.N. and Rathwell, G.W.1993, Paleobotany and Evolution on plants . Cambridge university press.
- Cavers, Interrelationship of Bryophyta.
- Udar, R. Bryophyta.
- Prempuri, Bryophyta
- Parihar , N.S An introduction of Embryophyta, Vol.I Bryophyta.
- Parihar , N.S An introduction of Embryophyta, Vol.II Bryophyta.
- Rashid A. An Introduction of pteridophyta.
- Vashishta, P.C. Pteridophyta.
- Smith, G.M. Cryptogamic Botany.
- Eames. J. Morphology of Vascular plants- Lower Groups.

Govt. V.Y.T. PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – I

PAPER – IV (Course Code- MBO104)

PLANT PHYSIOLOGY

M.M. – 80 **Min. - 16**

UNIT - I

- **Energy flow:**
  - Principles of thermodynamics, free energy & chemical potential, Redox reactions, structure & function of ATP.
- **Fundamentals of Enzymology:**
  - General aspects, Nature of enzymes, mode of enzyme action, classification, enzyme kinetics, Michaelis Menten Equation & its Significance,
  - Enzyme inhibition, allosteric mechanism, regulatory & active sites, isozymes, factors affecting enzyme activity.

UNIT – II

- **Membrane Transport & Translocation of water & solutes:**
  - Plant water relations – properties of water, diffusion, osmosis, permeability, plasmolysis, imbibition's, DPD.
  - Mechanism of water transport through xylem – absorption of water, ascent of sap, transpiration and mineral nutrition.
  - Root microbe interaction (mycorrhiza) in facilitating nutrient uptake,
  - Comparison of Xylem & Phloem transport.
  - Phloem loading & unloading (translocation) - active & passive solute transport.

UNIT – III

- **Signal Transduction:** overview, receptors & G-proteins,
  - Phospholipids signaling, role of cyclic nucleotides,
  - Calcium- Calmodulin cascade,
  - Diversity in protein kinases & phosphatases,
  - Specific signaling, eg:- Two component sensor regulator system in bacteria & plants,
  - Sucrose- sensing mechanism.

UNIT – IV

- **Plant Growth Regulators & Elicitors:** Physiological effects & mechanism of action of auxin, gibberllins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid & salicylic acid, hormone receptors.
- **Stress Physiology:** plant responses to biotic & abiotic stress, mechanism of biotic & abiotic tolerance, HR & SAR, water deficit & drought resistance, salinity stress, metal toxicity, cold & heat stress, oxidative stress.

Laboratory Exercise

- To determine osmotic pressure of cell sap by Plasmolytic method.
- To determine osmotic pressure of cell sap by Weight method.
- To determine the rate of transpiration by Ganong's photometer.
- To find out stomatal index of different mesophytic leaves.
- To determine absorption transpiration ratio.
- Comparison of cuticular and stomatal transpiration by Cobalt chloride method.
- Demonstration of Catalase activity.
- Demonstration of Peroxidase activity.
- Demonstration of Dehydrogenase activity.
- Demonstration of Amylase activity.
- Comparison of cuticular and stomatal transpiration by Blackman's apparatus.

Recommended Books :

- Cell Physiology by Giese.
- Plant Physiology by Bidwell.
- Plant Physiology by Subhash chandra Dutta.
- Plant Physiology by Noggle and Frutz.
- Plant Physiology by Devlin.
- Plant Physiology by Taiz and Zeiger .

Govt. V.Y.T. PG Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – II

PAPER – I (Course Code- MBO201)

GENETICS

Max. M. 80 Min. M. 16

UNIT-I

- **Chromatin Organization:**Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, chromatin and heterochromatin, banding pattern, Karyotype. Ribosomal RNA genes.
- **Special types of chromosomes**: Polytene, lamp brush, B chromosomes and sex chromosomes & Sex determination in plants.
- **Cytoplasmic inheritance:** Mitochondrial DNA & Cytoplasmic male sterility in plants.

UNIT-II

- **Structural alterations in chromosomes**: origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterozygotes;
- **Numerical alterations in chromosomes**: Aneuploids - monosomic, nullisomic, trisomic and tetrasomic; Euploids - haploids and polyploids; origin & production of autopolyploids, allopolyploids.
- **Genetics of prokaryotes and eukaryotic organelles:** Phage phenotype, genetic recombination in virus & bacteria (transformation, conjugation and transduction in bacteria).

UNIT-III

- **Genetic recombination**- Mechanism of crossing over, molecular mechanism ofgenetic recombination.
- Role of Rec-A ,Rec-B, Rec- C and Rec-D enzymes.
- Homologus &Site specific recombination,
- Linkage :- theories, types mechanism & linkage group.

UNIT-IV –

- **Chromosome inheritance**: Chromosome theories, mendelian laws, gene interaction.
- **Transposones :** transposable elements in prokaryotes and eukaryotes.
- **DNA damages & Repair**: mechanisms,inherited human diseases and defects in DNA repair.

Laboratory Exercise

- Problems on genetics: based on inheritance / interaction / crossing over / linkage.
- Karyotype analysis (Slide/ Photograph).
- To study the salivary gland chromosomes from Chironomous larva.

Recommended Books:-

- Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
- Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
- Gupta P.K Genetics , Rastogi Publications.
- Karp, G. 1999. Cell and Molecular Biology : Concept and Experiments. John Wiley and Sons, Inc., USA.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- Lewis, R. 1997. Human Genetics: Concepts and Application (Second Edition). WCB McGraw Hill, USA.
- Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
- Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
- Sariu C 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.
- Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
- Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
- Verma and Agarwal, Genetics, S. Chand Co, New Delhi.. 20. Singh B.D 2004. Genetics. Kalyani Publication, Ludhiana.

Govt. V.Y.T. PG Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – II

PAPER – II (Course Code- MBO202)

TAXONOMY OF ANGIOSPERMS

M.M. – 80 **Min. - 16**

UNIT– I

- **Taxonomy Tools**- Herbarium, Floras.
- **The species Concepts**- Taxonomic, hierarchy, species, Genus, family and other categories. Principles used in assessing relationship.
- Delimitation of taxa and attribution of rank. Salient features of international code of Botanical nomenclature.

UNIT– II

- **System of Angiosperm classification**: - Phenetic versus Phylogenetic Systems, cladistics in Taxonomy.
- Salient Features of the systems Proposed by Bantham and Hooker, Hutchinson, Takhtajan and Cronquist.
- **Taxonomic evidence** - Morphology, Anatomy, Palynology, Embryology-Cytology and Phytochemistry.

UNIT – III

- **Diversity of flowering plants**: General account of following families -
  - Dicotyledons – Polypetalae.
    - Ranales – Ranunculaceae, Magnoliaceae, Annonaceae, Nymphaeaceae.
    - Geraniales – Rutaceae, Meliaceae.
    - Myrtales – Myrtaceae, Lythraceae.

UNIT – IV

- **Diversity of flowering plants**: General account of following families -
  - Dicotyledons – Gamopetalae –
    - Asterales – Compositae,
    - Lamiales –Lamiaceae, Verbenaceae.
  - Monochlamydeae – Polygonaceae, Euphorbiaceae.
  - Monocotyledons – Musaceae, Liliaceae, Palmaceae, Cyperaceae.

Laboratory Exercise

❖ Description and classification of the following plants.

Dicot:

1. Polypetalae –
a. Delphinium
b. Annona sp.
c. Polyalthia longifolia
d. Nymphaea sp.
e. Azadirachta indica
f. Melia azadirach
g. Callistemon sp.
h. Lagerstromia sp.

2. Gamopetalae –
a. Members of Astereceae
b. Oscimum sp.
c. Hyptis
d. Lippia nodiflora
e. Vitex negundo
f. Duranta sp.

3. Monochlamydae –
a. Polygonum sp.
b. Antigonan leptopus
c. Croton sp.

4. Monocot:
a. Musaceae – Musa sp.
b. Liliaceae – Allium cepa
c. Cyperaceae – Cyperus rotandus

Recommended Books

- Mathur, R.C., Systematic Botany of Angiosperms.
- Rajkumar, Systematic Botany.
- Tyagi, Y.D. and Kchhetrapal, An Introduction to the Taxonomy of Angiosperms.
- Sumbhamusthi,v.S.S., Taxonomy of Angiosperms.
- Singh and Pandey, Jain, A Text book of Botany- Angiosperms.
- Chopra, G.L., Angiosperms.

Govt. V.Y.T. PG Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – II

PAPER – III (Course Code- MBO203)

MOLECULAR BIOLOGY

Max. M. 80 **Min. M. 16**

UNIT – I

- **DNA**: structure - A, B and Z forms, replication, RNA editing, RNA Splicing
- **tRNA**: Structure and function.
- **Protein Synthesis:**mechanism of protein synthesis, transcription in prokaryotes & eukaryotes, translation.

UNIT – II

- **Proteins sorting**: targeting of proteins to organelles.
- **Mutations**:
  - spontaneous and induced mutations, physical and chemical mutagens,
  - Molecular basis of gene mutations.
- Site directed mutagenesis.
- Robertsonian translocation, B-A translocation.

UNIT – III

- **Gene structure and expression**: fine structure of gene, Cis-trans test, fine structure analysis of eukaryotes, introns and their significance.
- Regulation of gene expression in prokaryotes (operon circuit) and eukaryotes (Britten-Davidson model).
- **Molecular Genetic mapping**: Genetic markers: RFLP, RAPD, AFLP, VNTRs.

UNIT – IV

- **Molecular Cytogenetics**:
  - Nuclear DNA content;
  - C - value paradox, cot curve and its significations,
  - Restrictions mapping, concept and techniques
- **Alien genes transfer through chromosomes manipulations**: transfer of whole genomes from Wheat, Brassica, Arachis; transfer of individual chromosomes and chromosomes segments; Inbreeding and heterosis.

Laboratory Exercise:

- Separation of proteins by SDS PAGE.
- Separation of plant DNA by Agarose Gel Electrophoresis.
- Isolation of DNA by CTAB Method.
- Isolation of plant DNA and quantification by UV spectrophoretic method.
- Restriction digestion of plantDNA, its separation by Agarose Gel Electrophoresis and visualization by ethidium bromide staining.
- Isolation of plant DNA from Onion (house hold method)

Recommended Books:-

- Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylar and Francis) New York Group (wt)
- Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular Biology of Plant. American Society of Plant Physiologist, Maryland, USA.
- Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).
- De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA.
- Gupta P.K Cell and Molecular biology Rastogi Publications.
- Gupta P.K, CytogeneticsRastogi Publications.
- Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- Lodish Etal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
- Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.

Govt. V.Y.T. PG Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – II

PAPER – IV (Course Code- MBO204)

PLANT METABOLISM

M.M. – 80 **Min. - 16**

UNIT - I

- **Photochemistry & photosynthesis:**
  - General concepts & historical background.
  - Evolution of photosynthetic apparatus, photosynthetic pigments & light harvesting complexes.
  - Photooxidation of water, mechanism of electron & proton transport (Hill reaction).
  - Carbon assimilation- the Calvin cycle, C4 cycle, CAM pathway.
  - Photorespiration & its significance.
  - Biosynthesis of Starch & Sucrose.

UNIT – II

- **Respiration & Lipid Metabolism:**
  - Overview of Plant respiration, Glycolysis, TCA cycle, electron transport & ATP synthesis, Pentose Phosphate pathway,
  - Glyoxalate pathway,
  - Alternative Oxidase system,
  - Structure & function of lipids fatty acid biosynthesis, synthesis of membrane lipids, structure lipids & storage lipids & their catabolism.

UNIT – III

- **Nitrogen fixation, nitrogen & sulphur metabolism:**
  - Biological Nitrogen fixation.
  - Nodule formation & Nod factors.
  - Mechanism of Nitrate uptake & reduction, ammonium assimilation.
  - Sulphur uptake, transport & assimilation.

UNIT – IV

- **Sensory Photo-Biology:**
  - History of discovery of phytochromes & Crytochromes, their photochemical & biochemical properties,
  - Photophysiology of light induced responses, cellular localization and molecular mechanism of action of photo-morphogenic receptors.
- **The flowering process:**
  - Photoperiodism & its significance, vernalisation - floral induction & development genetic & molecular analysis.
  - Endogenous clock & its regulation.

Laboratory Exercise

- ❖ Extraction and separation of chloroplast pigments by chemical method by Separating funnels.
- ❖ Separation of chloroplast pigments by Paper chromatography.
- ❖ Separation of plant pigments by Column chromatography.
- ❖ To demonstrate Hill's reaction.
- ❖ Separation of amino acids by Paper chromatography.
- ❖ To determine the rate of photosynthesis under different concentration of CO2 / different light intensity / different colours of light.
- ❖ Demonstration of fermentation by Kuhne's vessel.
- ❖ To determine RQ by Ganong's respiroscope / Hare's respiroscope.
- ❖ Protein test by Xanthoproteic reactions / Million's reaction.
- ❖ Demonstration of Catalase activity / Peroxidase activity / Dehydrogenase activity / Amylase activity.

Recommended Books

- ➢ Cell Physiology by Giese.
- ➢ Plant Physiology by Bidwell.
- ➢ Plant Physiology by Subhash Chandra Dutta.
- ➢ Plant Physiology by Noggle and Frutz.
- ➢ Plant Physiology by Devlin.
- ➢ Plant Physiology by Taiz and Zeiger.
- ➢ Photosynthesis by Robinowitch and Govindjee.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – III

PAPER – I (Course Code- MBO301)

PLANT DEVELOPMENT AND PLANT RESOURCES

Max. M. 80 **Min. M. 16**

UNIT-I

- **Introduction**: Unique features of plant development.
- **Seed germination and Seedling growth**, metabolism of nucleic acids, proteins and mobilization of food reserves hormonal control of seedling growth.
- **Seed dormancy**, overcoming of seed dormancy, Bud dormancy.
- **Root development**: Organization of root apical meristem (RAM), Vascular tissue differentiation of root, lateral roots, Root hairs, Root microbe interaction.

UNIT-II

- **Shoot Development**: Organization of shoot apical meristem (SAM). Control of tissue differentiation; especially Xylem and Phloem.
- **Secretory ducts and laticifers**,
- **Wood development** – Formation of annual ring, heart wood and sap wood, porous and non porous, autumn & spring wood, periderm, lenticels, tylosis,

UNIT-III

- **Leaf growth and differentiation**: Development; phyllotaxy; differentiation of epidermis (with special reference to stomata and trichome) and Mesophyll..
- **Senescence**, influences of hormones and environmental factors on sensescence.
- **Flower development**: Genetics of Floral organ differentiation: Homeotic mutant in *Arabidopsis* and *Antirrhinum*.

.

UNIT-IV

- **Plant resources**: Introduction, cultivation and uses of
    - **Food / Fodder crops**: Wheat, Rice, Sugarcane, Berseem, Black gram & Bengal gram.
    - **Vegetable Oil Yielding Crops**: Groundnut and Soyabean.
    - **Fiber Crops:** Cotton and Jute.
    - **Timber And Fire Wood Plants**:
    - Sal, Teak, Shisham, Deodar, Pines,
    - Babul, Amaltas, Emli, Bija, Jamun.
    - **Non Wood Forest Products (NWDPS):** Bamboos, Gums & Dyes (Sindoori, Heena).

Laboratory Exercise

- Study of alternate, opposite, opposite and superposed, opposite and decusscate, spiral leaf arrangement.
- Microscopic examination of V.S. of leaves (such as Nerium, Maize, Grass) to understand the internal structuure of the leaf tissues, trichome and glands etc.
- Study of epidermal peels of leaves of different plants; to study the structure of stomata and stomatal index.
- Microscopic examination of root (monocot, dicot, aerial root{Banyan}, hygroscopic {Vanda root}, assimilatary root {Tinospora}).
- Anatomy of stem (monocot and dicot). Study of stem modification.

{Field Survey}

- Listing of firewood and timber yielding trees of local origin. {Local name, Scientific name, Family, Properties}.
- Study of live or herbarium specimens or other visual materials to become familiar with these resources.
- Micro chemical tests for stored food material.

Recommended Books

- Fahn, A.1982, Plant Anatomy. (3rd Edi.). Pergamon Press, Oxford.
- Tayal, M.S. Plant Anatomy, Rastogi Pub.
- Vashista, P.C. Plant Anatomy, S. Chand.
- Pandey, B.P., Plant Anatomy.
- Chandurkar, Plant Anatomy.
- Emes, J. Plant Anatomy.
- Bendre, A. and Kumar, 2004 A. Rastogi pub. Meerut, India.
- Santra, S.C., Chattergee, T.P. and Das. 2005 A.P. College Botany Practical Vol. II New central pub. India.
- Botany of field crops, J.S. Nanda, P. K. Agarwal.
- Economic Botany in the tropics S. L. Kochhar.
- Hill's economic botany Dr. O.P, Sharma.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – III

PAPER – II (Course Code- MBO302)

PLANT ECOLOGY

Max. M. 80 **Min. M. 16**

UNIT-I

- **Ecosystem Organization**:
  - Law of Ecology , Structure – Structure of ecosystem (Abiotic, biotic components & ecological pyramids), Function of ecosystem (Productivity, food chain, food web, Nutrient cycles & Energy flow), Primary production (Methods of measurement, global pattern, controlling factors), Energy dynamics (tropic organization, energy flow pathways, ecological efficiencies).
  - Litter fall and decomposition (mechanism, substrate quality and climatic factors).
  - Global biogeochemical cycles of C, N, P and S mineral cycles (pathways and processes) in terrestrial and aquatic systems.

UNIT-II

- **Ecosystem Management**:
  - Concept (resistance and resilience), Ecological perturbations – Natural (flood, drought, fire, Volcano, landslide, earthquake, & cyclone) and anthropogenic (deforestation, desertification, usage of pesticide, insecticide, chemical fertilizers and plastics, water, air, soil, noise & nuclear pollutions and their impact on plants and ecosystems.
  - Ecology of plant invasion, environment impact assessment, ecosystem restorations.

Sustainable development : Concept, Strategies, Principle and threats of Sustainable development, Causes of unsustainability, Sustainable development-international & national efforts, Sustainability indicators.

UNIT-III

- **Vegetation and organization**:

Concepts of community and continuum, analysis of communities (analytical – quantitative (frequency, density, abundance, cover and basal area), qualitative (physiognomy, phenology, stratification, abundance, sociability, vitality & life forms), Synthetic characters (presence & constantance, fiedality, dominance, interspecific associations, index of similarity, species diversity, diversity index).

- Community coefficients, inter specific associations (Positive interaction & Negative interaction), ordination.
- **Population Ecology** : Characteristics of a population, Population growth curves, Population regulation, Life history strategies (r and K selection), Concept of metapopulation – Demes and Dispersal, interdemic extinctions, age structured populations.

UNIT-IV

Vegetation development:

- Temporal changes (cyclic and non cyclic). Types of ecological succession – hydrosere and xerosere, mechanism of ecological succession (relay floristic and initial floristic composition, facilitation and tolerance), change in ecosystem properties during succession. Climax concept in succession – monoclimax and polyclimax theory.

- **Habitat and Niche**: Concept of habitat and niche; niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.

Laboratory Exercise

- To determine minimum size and number of quadrat required for reliable estimate of biomass in grassland.
- To compare protected and unprotected grassland using community coefficients (similarity indices).
- To determine relative density of the species in a woodland using point centred quarter method.
- To determine relative frequency of the species in a woodland using point cantered quarter method.
- To estimate IVI of the species in a woodland using point cantered quarter method.
- To calculate mean, variance, standard deviation, standard error, coefficient of variations and to use t test for comparing two means related to ecological data.
- To find out the relationship between two ecological variables using correlation and regression analysis.
- To find out important grassland species using chi square test.

Recommended Books

- Shukla, R.S. and Chandel P.S. A text book of Plant Ecology including Ethno Botany and Soil Science.S.Chand and Company LTD.
- Dash, M.C., Fundamentals of Ecology, Tata McGraw Hill Company LTD.
- Sharma, P.D., Ecology and Environment, Rastogi Pub.
- Sharma, P.D., Environmental Biology, Rastogi Pub.
- Ambasht, R.S., A text book of Plat Ecology, Dev Jyoti Press, Varanasi.
- Arora, M. P., Ecology, Himalaya Pub. House.
- Tansley, A.G., An introduction to Plant Ecology, Discovery pub. House.
- Kochhar P.L. Plant Ecology , Genetics and Evolution, Jalandher.
- Arora Mohan p. , Ecology , Himalaya Pub. House.
- Weaver John E., Clements, E., Plant Ecology, Tata McGreaw Hill Company LTD.
- Odum Eugene, P. Fundamentals of Ecology, W.B. Sauneds Company.
- Kumar, H. S. General Ecology, Vikas Pub. House.
- Mishra, K.C. Manual of Plant Ecology , 3rd Ed. Oxford Pub. Company.
- Rana, S.V.S., Environmental Studies, Rastogi Pub.
- Benjamin cummings Publication Company, California.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology principles and applications, Cambridge University press, Cambridge, U.K.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – III

PAPER – III (Course Code- MBO303)

BIOTECHNOLOGY AND GENETIC ENGINEERING OF PLANTS

Max. M. 80 **Min. M. 16**

UNIT – I

- **Biotechnology**: Basic concepts, principles and scope.
- **Plant cell and tissue culture**: General introduction, history, scope, concept of cellular differentiation, cellular totipotency.
- **Cell Culture**: Single cell culture, suspension culture and application.
- **Culture media:** Types, constituents, Selection of media and media preparation.

UNIT – II

Application of plants tissue culture:

- Clonal propagation (Micropropagation) – Shoot culture, Apical meristem culture,
- Production of hybrids, soma clones and somaclonal variations,
- Artificial seed
- Production of secondary metabolites/natural products: Morphological and chemical differentiation, Media composition.

Strategies for plant conservation:

- *Ex-situ*: Genetic resource centre, Gene bank, Seed banks, in vitro repositories and Cryo banks, the department of Biotechnology (DBT) for conservation and non formal conservation efforts.
- *In-situ* conservation: National park, Sanctuaries, National reserve, Biosphere reserve, Natural monuments.

UNIT – III

Organogenesis and adventives embryogenesis: Fundamental aspects of morphogenesis, organogenesis via callus formation.

- Somatic embryogenesis (zygotic embryo, non zygotic embryos, somatic embryos, parthenogenetic embryo, androgenic embryo).
- Somatic androgenesis (direct and indirect), mechanisms, techniques and utility.

Somatic hybridization: Methods of Protoplast isolation, Spontaneous and induced methods of protoplasm fusion, identification and selection of hybrid cell, regeneration of hybrid plants; possibilities, achievements and limitations.

UNIT – IV

Genetic engineering of plants:

- Aims, Strategies and development of transgenic.
    - Gene transfer methods: Vector mediated gene transfer - Agro bacterium: the natural genetic engineer, Virus mediated gene transfer, Vectorless or Direct DNA transfer.
- Chloroplast transformation and its utility.
- Molecular maps of plant Genomes.

Laboratory Exercise

- To prepare plant tissue culture media.
- To prepare explants and its sterilization.
- To surface sterilization of plant material.
- To isolate protoplast from the plant tissues.
- To demonstrate callus culture technique.
- To demonstrate cell suspension culture.
- To demonstrate androgenesis in Datura.
- To demonstrate somatic embryogenesis.
- To demonstrate organogenesis.

Recommended Books

- Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice (a revised edition). Elsevier Science Publishers, New York, USA
- Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.
- Kumar, U. 2002. Methods in Plant tissue culture, 2nd Ed., Agrobios India
- Prakash, M. and Arora, C.K. 2003. Cell and Tissue culture, Anmol Pub, New Delhi.
- Jogdand, S.N.Industrial Biotechnology, , Himalaya Pub. House, Delhi.
- Elements of Biotechnology, P.K. Gupta, Rastogi Pub. Meerut 2003.
- Biotechnology, B.D. Singh, Kalyani Pub. New Delhi 2005.
- A text book of Biotechnology, R.C. Dubey, S.Chand Pub. New Delhi.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – III

PAPER-IV {Elective-I} (Course Code- MBO304)

MICROBIAL ECOLOGY

M.M. – 80 **Min. - 16**

UNIT - I

- **Methods in Microbial Ecology:**
  - Methods of cleaning, sterilization (Disinfection, incineration, physical method and chemical method), media preparation (Liquid and solid).
  - Enrichment and isolation methods, pure culture techniques (Pour plate, Streak plate, serial dilution). Identification and quantification (Micrometry).
- **Instrumentation (Principle, Structure and Functions):**
  - Autoclave, Colony counter, Hot air oven, Incubator, Laminar air flow,
  - Microscopy {Light microscope, Bright field microscope, Dark-field microscope, Phase-Contrast microscope, Fluorescent microscope, Electron microscope (Transmission and Scanning), Spectrophotometry.

UNIT - II

Microbial interaction

- **Clay-Humus-Microbe interaction.**
- **Plant-Microbe interaction**:
  - Interaction of above ground part - Destructive associations (diseases) - and beneficial association (symbiosis)
  - Interaction on below ground parts Destructive associations (diseases)
  - Beneficial association {Cyanobacterial (Cyanobacteria with Azolla and cycas)
  - Bacterial- associative symbiont, PGPR, Rhizobium, Actinomycetes, and
  - Fungal symbiosis - Mycorrhiza and their types).
- **Animal-Microbe interaction**:
  - Destructive association; Neutralism (normal microbiota of human body),
  - Symbiotic association (ectosymbiosis of protozoa, bacteria and fungi with insects and birds, endosymbiosis of bacteria and fungi with birds and insects, ruminant symbiosis).
- **Microbe-Microbe interaction:** Symbiosis, Antagonism, Ammensalism, Competition, Parasitism and Predation.

UNIT – III

Extremophiles – Definition, Introduction, Application and Importance.

- **(**Acidophiles, Alkalophiles, Halophiles, Psychrophiles, Barophiles, Thermophiles and Hyperthermophiles),

- **Microbes in Human Welfare** -
- **Microorganisms in human nutrition**
- **Biofertilizers** : types, Significance and advantages – Nitrogen fixing, Phospahte biofertilizer, Rhizobium, Azospirillum, Azotobactor, Cyanobacteria, Azolla, and Mycorrhiza
- **Organic Fertilizer** : Type, Advantages and Significance
- **Microbes in industries** : Production of ethanol, Acetone, Citric Acid, Antibiotics, Microbial Enzyme (Amylase, Protease, Lipase)
- **Microorganisms in agriculture** : **Bacteria** :- Arthrobacter, Clostridium
- **Actinomycetes** : Streptomycis,
- **Fungi** : Aspergillus, Mucor, AMF and PGPR
- **Protozoa** : Flagellates, Cilliates, and Amoebae, Nematodes

UNIT – IV

[Soil Microbiology]

- **Soil as a habitat for microorganisms:** Soil quality, Physico-chemical properties of soil (Organic matter; Soil, water &air; Soil microbes: algae, bacteria, actinomycetes, bacteriophages, protozoa, nematode and fungi).
- **Rhizosphere and rhizoplane microorganisms**,
- **Organic matter decomposition:**
  - Composition of litter (cellulose, hemi cellulose, lignin, water soluble components, ether and alcohol, soluble components and proteins)
  - Microorganisms associated with organic matter decomposition (cellulose decomposers, hemicellulose decomposers, lignin decomposers);
  - Factors affecting organic matter decomposition (litter quality, temperature, aeration, soil pH, inorganic chemicals,moisture);
- **Biogeochemical cycling:** Carbon cycle, Nitrogen cycle (nitrogen fixation, ammonification, nitrification, denitrification); Phosphorous cycle, Sulphur cycle**.**

Laboratory Exercise

- Methods in Microbial Ecology.
- Calibration of microscope: determination of dimensions of microorganisms (micrometery)
- Cultivation media for autotrophic and heterotrophic microorganisms (cleaning of glasswares, mineral media, complex media, solid media, sterilization).
- Isolation of microorganisms: spread plate/pour plate method/streaking on agar plates&preservation.
- Microscopic observation of root colonization by VAM fungi.
- Isolation of *Rhizobium* from soil/root nodules.
- Isolation and enumeration of rhizospheric microorganisms. Estimation of R:S ratio and assessment of Rhizospheric effect.
- Demonstration of bacterial antagonism.
- Isolation and enumeration of fungi from soil.
- Isolation of bacteria from soil.
- Demonstration/Isolation and identification of Cyanobacteria from soil.
- Soil Test.

Recommended Books

- A text book of Microbiology, R.C. Dubey and D.K. Maheshwari.
- Microbiology and Plant Pathology, P. D. Sharma.
- Microbiology. M. Pelczar, Chan and Krieg.
- A text book of Microbiology. R.M. Johri, Snehlata.
- Experiments in Microbiology, Plant Pathology and Biotechnology.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – III
PAPER-IV {Elective-II} (Course Code- MBO304)

ETHNOBOTANY

M.M. – 80 **Min. - 16**

Unit I

Ethnobotany : Introduction, concept, scope and objectives. Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. Major and minor ethnic groups or tribals of Chhattisgarh and their life styles. (Gond and Baiga)

Unit II

Role of ethnobotany in primary health care programmes

Ethno botany in india retrospect's & prospects in india -

Plants used by the tribals-

a) Food plants

b) Intoxicants and beverages

c) Resins , oils and miscellaneous uses

d) Sacred plants

Unit III

Indigenous System of medicines in india.

Ethnobotany on Development and Conservation on bio resources.

Methodology of ethnobotanical studies : (a) Field work (B) Herbarium

(c) Ancient Literature (d) Archaeological findings (e)Temples and sacred places

Unit IV

Ethnobotanical study of following plants with special reference to their medicinal importance

a) *Azadirachta indica* (Neem)

(b) *Emblica officinalis* (Amla)

(c) *Ricinus communis* (Andi)

(d) *Madhuca indica* (Mahua)

(e) *Cassia fistula* (Amaltash)

(f) *Ficus religiosa*(pipal)

(g) *Oscimum sanctum* (Tulsi)

(h)*Asparagus recemosus* (Satavar)

(i)*Aloe vera* (Ghritkumari)

(j)*Andrographispaniculata* (Bhuineem)

Laboratory Exercises-

- Description and identification of medicinal plants and its medicinal properties
- Preparation of medicinal plants herbarium and photograph
- Herbal preparation –
    a. Extract of Tulsi leaves.
    b. Ointment from Neem leaves
    c. Ayurvedic Tooth powder
    d. Amla Churna
    e. Face pack preparation from various herbs
- To cultivate at least 2 medicinal plants in earthen pots.

Suggested Readings :

- Baker H. G. 1978.Plants and civilization (3rd Edition) C. A. Wadsworth, Belmont.
- Chandel, K. P. S.,Shukla , G. & Sharma, N. 1996. Biodivrsity in medicinal and Aromatic plants in india. Conservation & Utilization. National Bureau of Plant Genetic Resources, New Delhi.
- Ambasta S. P. (ed) (1986). The useful plants of india. Publication & information Directorate, CSIR, New Delhi. India.
- Anon, (1978). The tribes of Madhya Pradesh, Dept. of tribal Welfare, Govt. of M. P.
- Cotton, C.M., (1996). Ethnobotany, Principals and Applications, John Willey & Sons,Chichester, New York.

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)
M.Sc. – BOTANY SEMESTER – IV
PAPER – I (Course Code- MBO401)

PLANT REPRODUCTION AND UTILIZATION OF RESOURCES

Max. M. – 80 **Min. M.- 16**

UNIT-I

- **Reproduction**: Methods of Vegetative propagation.
- **Pollination** – pollination – Mechanism and vector
- **Pollen - pistil interaction and Self-incompatibility**.
- Structure of pistil, Pollen stigma interaction, Sporophytic and gametophytic self-incompatibility
- **Fertilization**: Double fertilization, *in-vitro fertilization.*

UNIT-II

- **Male gametophyte**: Structure of anther & development of microsporangium and microsporogenesis, Role of tapetum. Pollen germination, Development of male gametophyte. Pollen storage, Pollen allergy.
- **Female gametophyte**: Structure of Ovule & development of megasporangium, megasporogenesis, Organization of embryo sac and Structure of mature embryo sac cells.

UNIT-III

- **Seed and Fruit development**:
  - **Endosperm** – development and types of endosperms, Xenia and Metaxenia, Mosaic and ruminate endosperm, function and morphological nature of endosperm.
  - **Embryogenesis** – development of dicot and monocot embryo, nutrition of embryo.
  - **Polyembryony**–types and significance of polyembryony.
  - **Apomixes** – types and significance of apomixes.
  - Endospermic &non-endospermic seeds, Dynamics of fruit growth and fruit maturation.

UNIT-IV

- **Utilization of resources**:
  - Plants Used As Avenue Trees**:** For Shade, Pollution control and aesthetics. {Banyan Tree, Neem, Karanj, Peepal, Siris, Saptparni, Amaltas, Gulmohar, Kadam, *Kachanar.*
  - General information about ethnobotanically important plants of Chhattisgarh.
  - Medicinally and aromatic important plants of Chhattisgarh
    - Aloe, Giloey, Gurmar, Satawari, Kirayat.
    - Tulsi, Dauna, Lemon grass, Mint, Sewanti.

Laboratory Exercise

- ❖ Study the structure of pollen grain {eg.Brasica, Hibiscus, Datura, Tridex, Thevesia,Ipomea, Solanum xanthocarpum}.
- ❖ Study the different types of placentation (Axile, Basal, Marginal Pariental, Free central){eg. Pea, Hibiscus, Brasica, Sunflower, Dianthus}.
- ❖ Isolation of mature embryo from Dicot and Monocot seed {Maize and Gram}.
- ❖ Study the types of pollination in saliva and Vallisneria, Calotropis.
- ❖ Study of Endospermic and nonendospermic seeds.
- ❖ Study of live or herbarium specimens or other visual materials to become familiar withthese resources.
- ❖ Botanical characters and their chief constituent of medicinal and aromatic plants.
- ❖ Survey of avenue trees (Local) {Identification, Size, Canopy shape, Status and their other uses}.

Recommended Books

- ➢ Bhojwani, S.S. and Bhatnagar, S.P. 2000.The Embryology of Angiosperm. 4th Ed.vikas Pub. House. N. Delhi.
- ➢ Shivanna, K.R. and Johri, B.M. 1985.The Angiosperm Pollen: Structure and Function. Wieley Eastern Ltd. New York.
- ➢ Maheshwari P.An introduction to the Embryology of Angiosperm.Tata Mc. Graw Hill Pub. Company LTD. New Delhi.
- ➢ Dawara, G.P. and Sharma S.K., Introductory Embryology, Jaiprakash nath and Company, Meerut.
- ➢ Singh, Pandey and Jain, Structure and Development of Angiosperm, Rastogi Pub
- ➢ Proctor. And Yeo, P. 1973. The Pollination of Flowers, William Collins, London.
- ➢ Raghavan V. 1997. Molecular Embryology of Flowering Plants. Cambridge University, Press, Cambridge.
- ➢ Medicinal Plants S. C. Joshi.
- ➢ The spirit of beautiful trees Raju.

Govt. V.Y.T. PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANYSEMESTER – IV

PAPER – II (Course Code- MBO402)

PLANT ECOLOGY – II (POLLUTION & BIODIVERSITY CONSERVATION)

Max. M. – 80 **Min. M.- 16**

UNIT-I

- **Climate, soil and vegetation patterns of the India:**
  - Climate of India. Life zones (Fresh & marine water),
  - World Major biomes – Terrestrial and Aquatic biomes (Fresh & Marine water).
  - World Major vegetation types – forest and grassland vegetation.
  - Soil, Soil genesis, Classification, Texture, Structure, Profiles and types of the India .

UNIT-II

- **Pollution, climate change and ecosystems :**

- Air, water and soil Pollution: - kinds, sources, Air quality parameters – C, S, Nitrogen compounds, Acid rain, Ozone, Fluorides, Hydrocarbons, Metals, Particulate Matter (PM), Aerosols & Toxicants. Water quality parameters – DO, BOD, COD, Turbidity, Nitrate, Chlorides &Phasphate, effects on plants & ecosystem.
- Green house gases (Carbon dioxide, methane, nitrous oxide,Chloro fluorocarbons: sources,trends and role).
- Ozone layer, ozone hole, consequences of climate change, (global warming, sea level, UV radiation).

UNIT-III

- **Biological diversity :**
  - Concepts and levels, status in India, Utilization and concerns, role of biodiversity in ecosystem functions and stability.
  - Speciation and extinction, IUCN categories of threat, distribution and global patterns, terrestrial biodiversity, hot spots.
  - World centers of primary diversity of domesticated plants: The Indo Burmese center, plant introductions and secondary centers, Diversity index (Shannon weavers,Margalf, & Pilou's methods)

UNIT-IV

- **Conservation strategies:**
  - Principles of conservation, environmental status of plants based on International Union for Conservation of Nature.
  - In situ conservation, International efforts and Indian initiatives, protected areas in India - sanctuaries national parks, biosphere reserves, Wetlands, Mangroves and coral reefs for conservation of wild biodiversity.
  - Ex situ conservation: Principles and practices, botanical gardens, field, general account of the activities of **Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agriculture Research (ICAR), Council of Scientific and Industrial Research (CSIR)** for conservation and non-formal conservation efforts.

Laboratory Exercise

- **Visit NBPGR, BSI, CSIR & ICAR, Recognized Botanical Gardens and Museum.**
- To determine soil moisture content, porosity and bulk density of soil collected from varying depths at different locations.
- To determine the water holding capacity of soils collected from different locations.
- To determine percent organic carbon and organic matter in the soils of cropland, grassland and forest.
- To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
- To estimate the dissolved oxygen content in eutrophic and oligotraphic water samples by azide modification method.
- To estimate chlorophyll content in sulphur dioxide fumigated and unfumigated plant leaves.
- Field survey of a part of town or city to make the students aware of the diversity of plants in urban ecosystems.

  Scientific Visit
- A protected area, A wetland, A Mangrove.

Recommended books :

- Magurran, A.E. 1988. Ecological diversity and its measurement, Chapman and Hall. London.
- APHA-AWWA-WPCF Standard methods for the examination of water and waste water, American public health association, Washington, D.C.
- Moore, P.W. and Chapman, S.B. 1986. Methods in plant Ecology, Blackwell scientific publications.
- Treshow, M. 1985. Air pollution and plant life, Wiley interscience.
- Mason C.F. 1991. Biology of fresh water pollution, Longman.
- Hill, M.K. 1997. Understanding Environmental pollution, Cambridge university press.
- Kothari, A. 1997. Understanding Biodiversity : Life sustainability and Equity, Orient Longman..
- Paroda, R.S. and Arora R.K. 1991. Plant resources conservation and management, IPGRIP usa campus, New Delhi.
- Heywood, V.H. and Watson, R.T. 1995. Global biodiversity assessment, Cambridge University press, Cambridge, U.K.

Govt. V.Y.T. PG Autonomous College Durg (C.G.)

M.Sc. – BOTANYSEMESTER – IV

PAPER – III (Course Code- MBO403)

BIOTECHNOLOGY AND GENETIC ENGINEERING OF MICROBES

Max. M. – 80 **Min. M.- 16**

UNIT – I

Recombinant DNA technology:

- Gene cloning - Principles and techniques, choice of vectors, cloning and expression vectors, chimeric DNA,
- Construction of genomic / cDNA libraries,
- DNA synthesis and sequencing: Sanger and Coulson Method, Maxam Gillbert method.
- Polymerase chain reaction: its variation, application, advantages and limitations.
- DNA fingerprinting and its applications.

UNIT – II

Genomics and proteomics: Genetic and physical mapping of genes.

- Molecular markers for introgression of useful traits, application.
- Artificial chromosomes,
- Genome projects,
- Bioinformatics
- Functional genomics,
- Protein profiling and its significance.

UNIT – III

Microbial genetic manipulation: Bacterial transformation, introduction of the recombinant DNA into a suitable host and identification of recombinant colonies, selection of recombinants and transformants.
Multiplication Expression and Integration of the DNA insert in host genome.

UNIT – IV

- Genetic improvement of industrial microbes and nitrogen fixers.
- Enzyme technology.
- Use of microbes in industry and agriculture.
- Intellectual property rights.
- Possible ecological risks and ethical concerns.
- Cryopreservation and germplasm storage.

Laboratory Exercise

- To study the effect of antibiotics on growth of microorganism.
- Restriction of digestion of microbial DNA, its seperation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
- Separation of RNA by Agarose gel electrophoresis and visualization by Et. Br. staining.
- Estimation of DNA

Recommended Books

- Biotechnological innovations in chemical synthesis, BOITOL Pub.,Butterworth.
- Industrial Microbiology, G. Reed (Editor), CBS Publishers, New Delhi.
- Industrial Biotechnology, S.N. Jogdand, Himalaya Pub. House, Delhi.
- Elements of Biotechnology, P.K. Gupta, Rastogi Pub. Meerut 2003.
- Biotechnology B.D. Singh, Kalyani Pub. New Delhi 2005.
- A text book of Biotechnology, R.C. Dubey, S.Chand Pub. New Delhi

Govt. V.Y.T. PG. Autonomous College Durg (C.G.)
M.Sc. – BOTANYSEMESTER – IV
PAPER-IV {Elective - I} (Course Code- MBO404)
MICROBIAL ECOLOGY

M. M. – 80 **Min. - 16**

UNIT - I

[Water Microbiology]

- **Types of water**: Atmospheric water, Surface water; Stored water (sedimentation, interaction of other microbes, light rays, temperature, food supply), Ground Water.
- **Water microorganisms**, Marine microbiology (estuaries, mangroves, deep sea, hydrothermal vent, saltpans, coral reefs), Fresh water microbiology (ponds, lakes, streams).
- **Microbial analysis of water**: Sanitary test for coliforms. Purification of water: Sedimentation, Filtration, Disinfection.

UNIT – II

[Air Microbiology]

- General introduction to air microflora, droplet nuclei, bioaerosol,
- **Indoor and outdoor aeromicrobiology**: aeromicroflora of pharmacy, aeromicroflora of hospitals and other houses, aeromicroflora of storage materials (library, wall paintings);
- **Aeroallergens and aero allergy**; House dust allergens; Pollen grains; Cosmetics;
- **Assessment of air quality** – Air sampling devices and equipments (impaction, liquid impingement, filtration, electrostatic precipitation and gravity sampling).
- **Phylloplanemicroflora**, Phylloplane pathogens (morphological characters, physiological characters; nutrition. Radiation. pH, temprature), microbial interaction on leaf surfaces.

UNIT – III

[Environmental Microbiology]

- **Waste as a resource:** Organic compost (definition, process of composting, factors affecting composting, microorganisms, soil and organic matter, role of compost).
- **Biogas production**: solubilization, acetogenesis and methanogenesis, mechanism of methane formation.
- **Sewage (wastewater) treatment**: Sewage microorganisms, BOD and COD, Small-scale sewage treatment (Cesspools, septic tanks), large-scale sewage treatment (primary, secondary).
- **Biodegradation**: microbial degradation of petroleum & xenobiotics, common process of insecticidal metabolism (hydrolytic process, reductive and oxidation).
- **Biodeterioration** of materials (cellulose, food stuffs, paints, rubbers, plastics, fuels, lubricants, metals, stone, cosmetics, toiletries structures). Microbial plastics.

UNIT - IV

- **[Plant Diseases -** Pathogen and symptoms**]**
  - **Bacterial disease** {Citrus canker, Bacterial blight of rice,Scab of potato, Angular leaf spot of cotton, Leaf spot of mango}
  - **Viral diseases** {Leaf curl of papaya, Mosaic of bhindi, Mosiac of Tobacco, Bunchy top of banana}

- **Fungal diseases** (Downy mildew of peas and Crucifers, Powdery mildews of Sisam, rusts diseases of Wheat and Gram, smuts diseases of Wheat and Barly, wilt diseases of Arhar}.

- **Medical Microbiology-** Pathogen and symptoms**:**
  - **Bacterial disease**: {Diphtheria, Pertussis, Tuberculosis, Pneumonia,Meningitis}
  - **Viral disease**: {Small pox, Chicken pox, Measles, Mumps, Influenza};
  - **Fungal disease**: {Aspergillosis, Blastomycosis, Candidiasis, Cryptococcosis, Histoplasmosis}.

Laboratory Exercise

- Water analysis by SPC method.
- Coliform test for water quality.
- Isolation of aquatic fungi by baiting technique.
- Isolation of aeromicroflora by slide exposure method.
- Isolation of aeromicroflora by petriplate exposure method.
- Isolation of Phylloplanemicrofloraby serial dilution method or Impression method.
- Physical analysis of sewage/industrial effluent by measuring Total Solids, Total DissolvedSolids and Total Suspended Solids.
- Determination of indices of pollution by measuring BOD/COD of different effluents.
- Identify and comments upon the plant diseases as per prescribed syllabus {Bacterial/Viral/Fungal}.

Recommended Books

- Dubey, R.C. and D.K., Maheshwari, A Text Bookof Microbiology.
- Sharma, P.D., Microbiology and Plant Pathology.
- Pelczar M. and Chan, Microbiology.
- Johri, R.M. and Snehlata, AText Book of Microbiology.
- Aneja, K.R., Experiments in Microbiology, Plant pathology and Biotechnology.
- Atlas, Microbial Ecology.

Govt. V.Y.T. PG. Autonomous College Durg (C.G.)
M.Sc. – BOTANY SEMESTER – IV
PAPER-IV {Elective - II}(Course Code- MBO404)
ETHNOBOTANY

M. M. – 80 **Min. - 16**

UNIT I

Traditional system of medicine–Brief history of use of medicinal herbs, introduction to indigenous systems of medicine Ayurveda ,Unani and Siddha system of medicine. Ethnobotany in relation to national pririties and health care programmes.

UNIT II

Ethnobotanical importance of Bacteria, Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. Ethnovaterinary medicines from plants. Major and minor forest products of Chhattisgarh.

UNIT III

Ethnobotany in relation to livelihood security, Reference to tribes. Ethnobotanical research done in India. Intellectual Property Rights with particular reference to Traditional knowledge and bio wealth.

UNIT IV

Role of ethnobotany in modern medicine, medico ethnobotanical sources in India – Significance of the following plants in ethnobotanical practices.(along with their habitat and morphology) *.a.Terminalia arjuna, bVitex negundo c.Pongamia pinnata* d. *Cassia auriculata, e Indigophera tinctoria.*, Role of ethnobotany in modern medicine with special example of *Rauvolfia serpentina, Withania somnifera,Tinospora cordifolia ,Vinca rosea, Moringa oleifera.*

Laboratory Exercises –

- Documentation techniques of Ethnobotanical knowledge
- Field study of forest area or Tribal area.
- Herbal Preparation –
  a. Preparation of Triphala.
  b. Kwath of Triphala
  c. Preparation of diabetes controlled powder
  d. Preparation of herbal shampoo
  e. Giloy Churn
- To separate active principals from the extract of medicinal plants

Suggested readings :-

- Jain S.K. and Rao R.R.(1971) A handbook of field and herbarium methods. New Delhi ,Today and Tomorrow's Printers and publishers.
- Jain S.K. (1989) Methods and approaches in Ethnobotany .Society of Ethnobotanist ,Lucknow.
- Vaishnaw T.K.(2004) Chhattisgarh ki Anusuchit Janjatiyan ,Adim JatiAnushandhanAvamPrashikshanSansthan Raipur Prakashankramank 2 pp.1-120.
- Joshi S.G.(2000) Medicinal plants, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi ,India.
- Kirtikar, K.R.& Basu B.D.(1933-1935),IndianMedicinal plants ,Vol.I to VIII (4 Vols text & 4 Vols. Plates) Reprint 1994,Dehradun U.P.
- Maheshwari ,J.K.Ed.(2000) Ethnobotany and Medicinal Plants of IndianSubcontinentScientific Publishers,Jodhpur.
- MartinG.J.(1995) Ethnobotany Chapman and Hall. London.