

NEHRU GRAM BHARATI VISHWAVIDYALAYA

KOTWA- JAMUNIPUR- DUBAWAL
ALLAHABAD (UTTAR PRADESH)

[From Academic Session 2017-18 onwards]



SYLLABUS *For the* M.Sc. – Botany (A Four Semester Course)

Based on
Choice Based Credit System (CBCS)

M.Sc. BOTANY Syllabus : Course Structure

First Semester

Course No.

BOT 501 Phycology

BOT 502 Mycology

BOT 503 Bryology

BOT 504 Microbiology

BOT 531 Practicals based on BOT 501 and BOT 502

BOT 532 Practicals based on BOT 503 and BOT 504

Second Semester

Course No.

BOT 505 Pteridophytes, Gymnosperms and Palaeobotany

BOT 506 Cell Biology and Instrumentation

BOT 507 Plant physiology and Biochemistry

BOT 508 Molecular Biology and Genetic Engineering

BOT 533 Practicals based on BOT 505 and BOT 506

BOT 534 Practicals based on BOT 507 and BOT 508

M.Sc. Part – II

Third Semester

Course No.

BOT 509 Developmental Botany

BOT 510 Ecology and Environment

BOT 511 Biostatistics

BOT 512 Genetics and plant breeding

BOT 535 Practicals based on BOT 509 and BOT 510

BOT 536 Practicals based on BOT 511 and 512

Seminar -1

Fourth Semester

Course No.

BOT 513 Plant diversity and resource utilization

BOT 514 Plant Pathology

BOT 515 Plant cell and Tissue culture

Elective Papers

BOT 516 Cytogenetics and plant breeding

BOT 517 Environmental management

BOT 518 Microbial genetics and Biotechnology

BOT 519 Angiosperms

BOT 537 Practicals based on 513

BOT 538 Practicals based on Elective papers – BOT 513 to BOT 519

Seminar 2

Project Work

BOT 501-Phycology

UNIT 1(0.5 Credit)

1. Historical perspectives. Principles, criteria (pigments, flagellation, reserve food),

Systems of classification given by Chapman, G.M Smith and modern system

UNIT 2 (1.0 Credit)

2. Cyanophyta: -

Cell organization, thallus type, asexual reproduction, heterocyst,
Genera like Oscillatoria, nostoc, Rivularia, Scytonema, etc

3. Chlorophyta and Charophyta:

Range of thallus, sexual, asexual reproduction, life cycle pattern with respect to orders and genera

Chlamydomonas, Gonium, Pandorina, Eudorina, Volvox, Chlorella,
Pediastrum, Hydrodictyon, Scenedesmus, Ulothrix, Stigeoclonium,
Cladophora, Draparnaldiopsis, Fristschiella, Chara, Nitella,
Coleochaete, Ulva, Caulerpa, Oedogonium, Zygnema,

UNIT 3(0.5 Credit)

4. Phaeophyta and Rhodophyta: -
Thallus organization, asexual and sexual reproduction, interrelationships

Ectocarpus, Dictyota, Sargassum.

Porphyra, Batrachospermum, Polysiphonia.

UNIT 4(0.5 Credit)

5. General character, occurrence, cell structure of Xanthophyta, Chrysophyta, Bacillariophyta, Pyrrophyta, Prasinophyta , Prochlorophyta .

UNIT 5 (0.5 Credit)

Algae in diverse habitat, Algal blooms, Algae as a food, biofertilizers and source of phycocolloids.

Practicals: 1. Comparative investigation of gross morphology, extent of differentiation of cyanobacteria and eukaryotic algae
2. Collection of samples of algae and preparation of temporary and permanent mount of algae under study with identification
3. To examine and record the asexual and sexual reproductive features of some representative genera of algae

References

1. Bold, H.C. & Wayne, M.J. 1996 (2nd Ed.) Introduction to Algae.
2. Van den Hoek, C.; Mann, D.J. & Jahns, H.M. 1995. Algae: An introduction to Phycology. Cambridge Univ. Press.
3. Lee, R.E. 2008. Phycology, Fourth Edition, Cambridge University Press, USA.
4. Kumar, H.D. 1999. Introductory Phycology. Aff. East-west Press Pvt Ltd., Delhi
5. vasishtha&vasishths.

BOT 502- Mycology

UNIT 1(1.0 Credit)

1. Historical perspectives Introduction, scope and general principles of classification of fungi

2. Myxomycotina: The slime moulds, general characters, somatic phase
Reproduction, alternation of generation, origin and phylogenetic
Relationships, Physarales(Physarum)

UNIT 2 (0.5 Credit)

3. Mastigomycotina: General character, mycelium, asexual and sexual reproduction, place of meiosis; Chytridiales (Synchytrium endobioticum), Blastocladales (Allomyces), Saprolegniales(Saprolegnia) and Peronosporales(Plasmopara, peronospora, Sclerospora)

4. Zygomycotina: Distinctive features, Thallus, reproduction; Mucorales (Rhizopus, Pilobolus)

UNIT 3(0.5 Credit)

5. Ascomycotina: General character, diagnostic feature, thallus, reproduction, development of asci, kinds of ascocarps ; Endomycetales(Saccharomyces cerevisiae), Taphrinales(Taphrinadeformans)Erysiphales(Erysiphae,Sphaerotheca), Eurotiales(Aspergillus), and Pezizales(Claviceps, Ascobolus)

UNIT 4 (0.5 Credit)

6. Basidiomycotina: General features, clamp connections, dikaryotisation, asexual and sexual reproduction and classification; Uredinales(Puccinia,melampsora),Ustilaginales (Ustilago), Lycoperdales (Lycoperdon), Nidulariales (cyathus), Agaricales (agricus), Aphyllophorales (polyporus)

UNIT 5(0.5 Credit)

7. Deuteromycotina: General features, conidia Sphaeropsidales (Phyllosticta), Melanconiales(Colletotrichum), Moniliales(Fusarium,Alternaria) and Mycelia sterilia

8. Lichens: Thallus structure, reproduction and economic importance

Practicals 1. To examine and identify morphological and cellular features of an unknown fungal colony with unaided eye and using optical devices

2. To identify the stages of sexual reproduction of given fungi.
3. To examine the fruiting body of different fungi and distinguish among them
4. Prepare a scrap mount spores of puccinia, ustilago etc
5. Cut section of ascocarp of ascobolus

References 1. Alexopoulos C.J., Mims C.W. and Blackwell M.I. 1996. Introductory Mycology. John Wiley and Sons Inc.

2. Mehrotra R.S and Aneja R.S 1998. An introduction to Mycology. New Age Intermediate Press.

3. Rangaswamy G. and Mahadevan A. 1999. Diseases of crop plants in India (Fourth Edition) Prentice Hall of India Pvt. Ltd. New Delhi.

4. Round F.E. 1986. The Biology of Algae. Cambridge University Press, Cambridge.

5. Webster J. 1985. Introduction to Fungi. Cambridge University Press.

6. Hawker L.E. 1967. An Introduction to Fungi Cambridge. Publication.

7. Kamat M.N 1959. Hand Book of Mycology, Prakash Publication.

8. Vashista B.R & A.K Sinha 2005. Botany for degree students – Fungi, S.Chands Publication.

9. Ainsworth G.C 1973. The Fungi Vol IV A, IV B Academic

BOT 503- Bryology

UNIT1(0.5 Credit)

1. Introduction Historical perspectives, Habit and Habitat, Distribution, systems of classification of Bryophytes .

UNIT 2(1.0 Credit)

2. General characters Morphology and anatomy of vegetative and reproductive structures of the followings –

Sphaerocarcales, Marchantiales (Riccia, Marchantia),
Jungermanniales Acrogynae (Porella, Frullania),
Jungermanniales Unacrogynae (Pellia), Calobryales, Takakiales,

UNIT 3(0.5 Credit)

**3. Anthocerotales (Anthoceros, Notothylas), Sphagnales (Sphagnum),
Andreaeales, Polytrichales (Polytrichum), Funariales**

.

UNIT 4 (0.5 Credit)

4. Theory of sterilisation
e. Sporophytic structure and evolution.
f. Origin of bryophytes

UNIT 5(0.5 Credit)

5. Bryophytes as bioindicators
6. Economic significance of Bryophytes.

Practicals

1. To examine the internal structure of a given Bryophytes
2. classify the bryophyte in one of the three groups on the basis of internal structure
3. Prepare the slides for examination of reproductive structures
4. Examine, identify and describe the reproductive structures such as gemma cups, antheridia, archegonia and spore bearing structures
5. preparation of permanent slides

References: -

1. Parihar N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
2. Puri P. 1980. Bryophytes. Atma Ram and Sons, Delhi.

3. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophyta, S.Chands Publication
5. Ainsworth G.C 1973. The Fungi Vol IV A, IV B Academic Press.

BOT504- Microbiology

UNIT 1(0.5 Credit)

1. A brief of microbial diversity with historical perspectives, a general account of archaea.
2. Nutritional types of microorganism, Rhizobium-legume association, Mycorrhiza

UNIT 2(0.5 Credit)

3. Anoxygenic photosynthesis with special reference to light reaction in purple bacteria; Methanogenesis.
4. Genetics of bacteria: genetic recombination; Mechanism of transformation, conjugation and transduction in bacteria, transformation and mapping of genes, conjugation and genetic mapping, Role of bacteria in genetic engineering

UNIT 3(1.0 Credit)

5. Lytic cycle in T- even phages and its regulation; Lysogeny and its regulation in lambda phage, gene fine structure, Applying complementation test to rII locus, overlapping genes, plasmids, microbial growth, aerobic and anaerobic respiration, a brief of viroids and prions.

UNIT 4(0.5 Credit)

6. Microbiology of water and waste water, microbiology of soil, fermentation (antibiotic fermentation and ethanol fermentation) Water-borne pathogenic microbes; role of microbes in waste water treatment with special reference to activated sludge.

UNIT 5(0.5 Credit)

7. Basic design of a fermentor; Biosensor; Bioremediation of hydrocarbon and metal polluted waters.

Practicals-

1. Differential staining procedure
2. Rhizobium isolation from legumes
3. Serial dilution process and application
4. Replica plating technique
5. Sterilization techniques
6. Isolation and culture of microbes from given Samples

References- Davidfreifelder(1995). Microbial genetics
Old,R.W and S.B primrose(1994).principles of gene manipulation
Stanier,R.Y. general microbiology
William Hays(1984).the genetics of bacteria and their viruses

BOT 505 - Pteridophytes, Gymnosperms and palaeobotany

UNIT1(0.5 Credit)

1. Introduction: - Historical perspectives, early vascular plants; Rhyniophyta, Trimerophytophyta, Zosterophylophyta

UNIT2 (0.5 Credit)

Habit and habitat, Plant body organization, Gametophyte and Sporophyte - evolution, Life cycle pattern, Comparative account of systems of classification with examples, Evolutionary significance of heteroporous Pteridophytes, Indian pteridology.

UNIT3(0.5 Credit)

2. Comparative account of morphology, anatomy of gametophyte and sporophyte of –
Psilotales, Lycopodiales, Isoetales, Equisetales, Ophioglossales, Maratiales, Osmundales, Filicales.

3. economic importance of pteridophytes, Apogamy, Apospory, telome concept
4. kinds of fossils and process of fossilization

Gymnosperms: -

UNIT4(1.5 Credit)

1. Introduction: - Historical perspectives
Habit, Habitat, Distribution, Plant body organization, Life cycle pattern,
Comparative account of systems of classification-
2. general account of glossopteridaceae

UNIT5

3. Comparative account of structure of sporophyte and gametophyte of –
Cycadales, Ginkgoales, Coniferales, Gnetales, Ephedrales, Welwitschiales.
4. Gymnosperm as prospective ancestor of angiosperms.
5. Economic values of Gymnosperms

Practicals

(Pteridophytes, Gymnosperms)

Pteridophytes:

1. Study of the following members to observe arrangement of Sori on a receptacle : -

Isoetes, Osmunda, Angiopteris, Ceratopteris, Achrostichum.

2. Morphology, Anatomy and reproductive structures of : -

Psilotum, Selaginella, Lycopodium, Equisetum, Ophioglossum,

Lygodium, Pteris, Pteridium, Salvinia,

Adiantum, Azolla.

Gymnosperms: -

Morphology, Anatomy and reproductive structures of –

Cycas, Zamia, Ginkgo, Pinus, Araucaria, Taxus, Cedrus, Picea, Thuja,

Podocarpus, Gnetum, Ephedra.

References: -

1. Sporne K.R. 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd. Bombay.
2. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
3. Bhatnagar S.P and Moitra Alok 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470 pp.
4. Biswas C and Johari B.M 2004. The Gymnosperms Narosa Publishing House, New Delhi. 497 pp.
5. Sporne K.R 1965. The Morphology of Gymnosperms London, pp. 216.
6. Bierhorst D.W. 1971. Morphology of Vascular Plants. New York and London.
7. Chamberlain C.J 1934. Gymnosperms-Structure and Evolution, Chicago. (Page 19)
8. Coulter J.M. and Chamberlain C.J. 1917. Morphology of Gymnosperms, Chicago.
9. Foster A.S and Gifford E.M 1959. Comparative Morphology of Vascular Plants. San Francisco.
10. Maheshwari P. and Vasil, Vimla 1961. Gnetum, Delhi.

BOT 506- Cell Biology and Instrumentation

UNIT 1(1.0 Credit)

1. Introduction: -

Evolution of eukaryotic cell from prokaryotic cells.

2. The Dynamics of Cell: -

Structural organization of plant cell, sub cellular organization, Totipotency and cell differentiation, cytoplasmic matrix (Properties and organization)

3. Biogenesis, Ultra structure and functions of: -

i. Cell wall

ii. Plasma membrane

iii. Plastids

iv. Endoplasmic reticulum

v. Mitochondria

vi. Golgi apparatus

vii. Plasmodesmata

viii. Plant Vacuole

ix. Nucleus

x. Ribosome

xi. Lysosomes, Peroxisomes and Glyoxysomes

cell secretion, endosome, coated vesicle, intracellular trafficking and cell sorting.

UNIT 2(1.0 Credit)

4. Chromosomes: -

Structure, Types, packing of DNA, Nucleosome organization, molecular organization of centromere and Telomere, Giant chromosomes.

5. Cell cycle and apoptosis: -

Mechanism of cell division, mitosis and meiosis, cell differentiation, control mechanisms, role of cyclins and cyclin dependent kinases cell-cell interaction, malignant growth, immune response, dosage compensation.

6. Cell signaling in Plants: -

Concept, Photoproteins-light responsive proteins, Receptor/threonine kinase, Ethylene activated two component signaling pathway, plant wound signaling pathway.

UNIT 3 (1.0 Credit)

7. Instrumentation: -

Microscopy: - Simple, Compound, Phase contrast, Fluorescence, Electron (SEM and TEM) microscopy, Micrometry

Centrifugation: - Rotors, Bench top, Low speed, High speed, Cooling, Ultracentrifuge.

Electrophoresis: - Native, Denaturing, Isoelectric focusing, 2 D Electrophoreses.

UNIT 4

Spectroscopy: - UV, Visible, IR, Raman,

Radioactivity: - GM counting, Scintillation counting, Autoradiography.

UNIT 5

Immunology:-Antigen-Antibody interaction. Immunodiffusion, Immunoprecipitation, Immunoelectrophoresis, RIA, ELISA.

Chromatography: - Paper, TLC, Column, Gel Filtration, Affinity, Ion Exchange, HPLC, GC.

Microtomy

Practicals

1. Identification of different stages of mitosis and study of morphology of metaphase chromosomes from Onion root meristems.
2. Identification of different stages of meiosis from suitable plant material. (Onion Buds).
3. Orcein staining of salivary gland chromosomes of Chironomas or Drosophila.
4. Isolation of cell organelles: Mitochondria, Chloroplast, Nucleus, the assay by succinate dehydrogenase activity(Mitochondria), acid phosphatase activity (Lysosomes), acetocarmine staining (Nucleus) and Microscopic observation (Chloroplast).
5. Study of mitotic index from suitable plant material.
6. Techniques of preparation of permanent and semi permanent slides.

Instrumentation:

1. Demonstration of microscopes (phase contrast, fluorescence, SEM, TEM)
2. Micrometry of pollen grains.
3. Camera Lucida sketching of suitable stages and karyotyping.
4. Microtome techniques
5. Immunodiffusion and Immunoprecipitation.

References:-

1. De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
2. Sadova David – 2004 (First Indian Edition). Cell Biology, New Delhi.
3. Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylor and Francis) New York Group (wt)
4. LodishEtal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
5. Giese Arthur 1979 (Fifth Edition). Cell Physiology, Toppan company Ltd., Tokyo, Japan.
6. Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).
7. Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.
8. Roy S.C and KKDe 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.

9. Verma P.S and Agarwal V.K 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology.S.Chand and Company, New Delhi.

10. Gerald Karp 1999 Cell

BOT –507 Plant Physiology and Biochemistry

UNIT (0.5 Credit)

1. Plant Water Relation: -

Regulation of water supply, Aquaporins and facilitated water Transport, Soil plant atmosphere continuum (SPAC), Recent concept in stomatal physiology,

2. Solute Transport: - Osmosis, Concept of water potential, osmotic potential, pressure potential and matric potential etc

Diffusion, Nerst equation, Uniport, Symport, Antiport channels, ATP driven active transport, chemiosmotic theory, (Phloem loading and unloading).

UNIT 2(0.5 Credit)

3. Photochemistry and Photosynthesis: -

Photosynthetic pigments, absorption and transformation of radiant energy, Light harvesting complexes, ETS, C₃ cycle, Regulation of Calvin cycle, RUBISCO activity, Photorespiration, CAM, C₄ Pathway.

4. Respiration: -

Overview of plant Respiration, EMP pathway, TCA cycle, PPP, Glyoxylate cycle, Mitochondrial ETS, Cyanide resistance pathway, Gluconeogenesis, High energy compounds: Synthesis and utilization, ATP synthesis.

Nitrogen and sulphur metabolism: biological nitrogen fixation, biochemistry and genetics of nitrogen fixation, nitrate assimilation, ammonia assimilation, nitrogen control of

nitrogen assimilation, sulphur assimilation, metabolic interrelation of nitrogen, carbon and sulphur

UNIT 3(0.5 Credit)

5. Plant growth regulators

Biosynthesis and action mechanism of :Auxins Gibberellins, (GA), Cytokinins, Ethylene, Absciscic Acid, Introduction of other hormones.

6. Seed Germination, Flowering and Fruit ripening: -

Metabolic changes during seed germination, flowering initiation, maturity and fruiting, fruit ripening.

7. Stress Physiology: -

Biotic and abiotic stresses.

UNIT 4 (0.5 Credit)

1. Energy Dynamics: -

Structure of atoms, molecules and chemical bonds, principles of physical chemistry, principles of thermodynamics, Bioenergetics, free energy, Redox potentials, Dissociation and associations constants, Activation energy, Binding energy.

2. Enzymology: -

General classification of Allosteric mechanism, Isozymes, Factors affecting enzyme activity, Enzyme Kinetics, Michaelis – Menton equation, Competitive and non competitive inhibition.

UNIT 5(1.0 Credit)

3. Carbohydrates: -

General classification, Synthesis and breakdown of carbohydrates (starch, glycogen, pectin, Glucose)

4. Amino acids and proteins: -

General classification of amino acids and proteins, Structure, synthesis and properties of amino acids, protein structure (Primary, secondary, tertiary and quaternary), Ramchandran plot.

5. Secondary metabolites: -

General classification of Major pathways, Phenolics (Lignins, tannins) Flavonoids, terpenoids (steroids), Alkaloids, pigments (Carotenoids, Anthocyanins)

7. Lipid metabolism: -

General classification of Phospho, Spingo, Glyco Lipid biosynthesis and oxidation.

Practicals

Plant Physiology Practicals: -

1. Test for viability of seeds.
2. Measurement of water potential of a plant tissue
3. Separation of leaf pigments by chromatography.
4. Induction of Nitrate reductase by nitrate ion and light.
5. To observe elongation of coleoptiles by treatment with 2,4-D.
6. To determine the activity of enzyme amylase in germinating seeds and its induction by GA.
7. Hill Reaction.

Biochemistry Practicals: -

1. Preparation of i) solutions of different molarity and normality.
ii) Buffers of different molarity and pH.
2. To demonstrate the action of Xanthine oxidase, phenolase complex .
3. To determine the units of activity and specific activity of α - amylase enzyme.
4. Qualitative test for organic constituents of cells
5. Separation of isozymes of peroxidases by native polyacrylamide gel electrophoresis.
6. To study biochemical changes during leaf senescence.
7. Desalting of proteins by gel filtration chromatography employing sephadix G – 25.
8. Separation of pigments by paper chromatography and TLC

References: -

1. **Buchanan B.B, Gruissem W. and Jones R.L** 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
2. **Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds)** 1997. Plant Metabolism (Second Edition) Longman, Essex, England.
3. **Galstone A.W.** 1989. Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..
4. **Moore T.C.** 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.
5. **Nobel P.S** 1999. Physiochemical and Environmental Plant Physiology (Second Edition) Academic Press, San Diego, USA.
6. **Salisbury F.B and Ross C.W** 1992. Plant physiology (Fourth Edition) Wadsworth Publishing Company, California, USA.
11. **Leninger A.C** 1987. Principles of Biochemistry, CBS Publishers and Distributors

BOT 508 – Molecular Biology and Genetic Engineering

UNIT 1(0.5 Credit)

1. Structure and Properties of Nucleic acids: -

Structure, Chemical, Physical, Spectroscopic and thermal properties of nucleic acids. (Buoyant density, Melting temperature, Effect of acid and alkali, UV absorption, hypo and hyperchromicity), Dissociation and reassociation kinetics of DNA, Cot curves, Cot $\frac{1}{2}$ values and its significance. Unique, moderately repetitive and highly repetitive DNA, forms of DNA. (A, B, C, Z) RNA as a genetic material.

UNIT 2(0.5 Credit)

2. Gene Structure: -

Organization and Structure of prokaryotic and eukaryotic genes; structure and role of promoters, exons, introns, terminators and enhancers.

3. DNA Replication: -

Mechanism of prokaryotic and eukaryotic DNA replication, replication apparatus, Origins of replication, priming and DNA polymerases. Rolling circle and theta (\square) models.

4. DNA damage and repair: -

Types of DNA damage, enzymes involving in repairing of DNA, excision repair, mismatch repair systems.

5. Transcription: -

RNA polymerases and their role, Transcription apparatus, Transcription in prokaryotes and eukaryotes, Initiation, elongation and termination, RNA processing, reverse transcription and cDNA synthesis, Ribonucleoproteins, Structure of mRNA.

UNIT 3(1.0 Credit)

6. Regulation of Transcription in prokaryotes and eukaryotes: -

Operon concept (Lac, Tryptophan, Arabinose) positive and negative regulation of prokaryotic genes, eukaryotic transcription factors.

7. Protein synthesis: -

Structure of rRNA, tRNA and Ribosomal assembly. Mechanism of protein synthesis in prokaryotes and eukaryotes; initiation, elongation and termination. Translational and post translational control. Targeting of organelle proteins, protein folding and processing. Chaperones.

UNIT 4(0.5 Credit)

8. Genetic Engineering: -

Machinery used in genetic engineering –

i. Cloning vectors (plasmid and bacteriophage vectors, cosmids BAC and YACs.

ii. Enzyme (restriction endonucleases, polymerases, reverse transcriptase, alkaline phosphatase, polynucleotide kinase, Ligases, terminaltransferases)

iii. DNA cloning, preparation of plasmid DNA, Restriction and electrophoresis, ligation, transformation and analysis of recombinants.

UNIT 5(0.5 Credit)

9. Plant Genetic Engineering: -

Methods of direct and indirect gene transfer in plants, *Agrobacterium*, Ti and Ri plasmids, application of genetic engineering, transgenic plants for insect, fungal, bacterial disease resistance, lignin, modification, abiotic stress tolerance, production of useful products.

10. Techniques of Genetic Engineering: -

Principles and methods of Genetic Engineering, Gene libraries and cDNA libraries, Polymerase chain reaction, DNA fingerprinting, DNA Synthesis, DNA Sequencing, Southern blotting, RAPD, RFLP, Restriction mapping. Introduction to Genomics, Proteomics and Bioinformatics.

References: -

1. Lewin B. 2000. Genes VII. Oxford University Press, New York.
2. Alberts, B., Bray, D Lewis, J., Raff, M., Roberts, K and Walter 1999. Molecular Biology of the Cell. Garland Publishing, Inc., New York.
(Page 25)
3. Wolfe S.L 1993 Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
4. Rost, T. Etal 1998. Plant Biology. Wadsworth Publishing Company, California, USA.
5. Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
6. Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular.
7. Biology of Plant. American Society of Plant Physiologist, Maryland, USA

Practicals

1. Isolation of plant genomic DNA and its quantification by UV-spectrophotometric method.
2. Isolation of plasmid DNA and demonstration of nicked, super coiled forms on Agarose gel electrophoresis and visualization by ethidium bromide staining.
3. Restriction digestion of DNA and its analysis by Agarose gel electrophoresis
4. SDS-PAGE analysis of seed storage proteins (globulins) from legumes.
5. Isolation of RNA and its quantification by UV - spectrophotometric method.

BOT -509- Developmental Botany

UNIT 1(0.5

Credit)

1. Meristems; patterns of cell fate, determination and lineage in root and shoot;
2. leaf growth and differentiation; secondary growth; wood development and its diversity; cambial variants; ultrastructure and control of xylem and phloem differentiation

UNIT 2 (1.0 Credit)

3. secretory ducts and laticifers;
4. flower, seed and fruit anatomy; patterns of evolution in seed; anatomical adaptations for special habitats, biotic and abiotic stresses

5. Transition to flowering - vegetative to reproductive evocation, floral homeotic mutations in *Arabidopsis*, *Antirrhinum* and *Petunia*, axis development in flower, gender expression in monoecious and dioecious plants.

UNIT3(0.5 Credit)

6. Developmental biology of male and female gametophytes: Regulation of anther and ovule development, microsporogenesis and microgametogenesis, megasporogenesis and megagametogenesis, male sterility- mechanisms and applications, pollen embryogenesis.

UNIT4 (0.5 Credit)

7. Pollen-pistil interaction: *In vivo* and *in vitro* pollen germination, pollen tube growth and

guidance, double fertilization, self-incompatibility mechanisms,

UNIT 5 (0.5 Credit)

8. Embryogenesis and seed development: Polarity during embryogenesis, pattern mutants, *in vitro* fertilization, endosperm development, apomixis, polyembryony, somatic embryogenesis.

PRACTICALS:

1. Study of apical meristems with the help of dissections, whole mount preparations, sections and permanent slides.
2. Origin and development of epidermal structures (trichomes, glands and lenticels).
3. Study of xylem and phloem elements using maceration, staining, light and electron micrographs (xerophytes, hydrophytes and halophytes).
4. Study of secretory structures (nectaries and laticifers).
5. Study of secondary growth (normal and unusual) of selected woods with the help of wood microtome and permanent slides.
6. Pollen *in vitro* germination methods: Sitting drop culture, suspension culture, surface culture.
16. Study of post-fertilization stage with the help of permanent slides and electron micrographs.
17. Dissection of embryo and endosperm.

References

1. Anderson RA (2005) Algal Culturing Techniques. Physiological Society of America. Elsevier Academic Press, USA.
2. Bhatnagar SP and Moitra A (2005) Gymnosperms. New Age Interactive (P) Ltd. Publishers, New Delhi.
3. Carlquist S (2001). Comparative Wood Anatomy, Springer-Verlag, Germany.
5. Cutler DF (1978). Applied Plant Anatomy, Longman, United Kingdom
6. Cutter EG (1978) Plant Anatomy, Part I & II, Edward Arnold, United Kingdom.
7. Dickinson WC (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA.
8. Fahn A (1974) Plant Anatomy, Pergamon Press, USA & UK.
9. Fosket DE. (1994) Plant, Growth and Development: A Molecular Approach, Academic

Press.

10. Fritsch FE (1935, 1945). The Structure and Reproduction of Algae Vols.I and II. Cambridge University Press, Cambridge, UK.

11. Hopkins WG. (2006). The Green World: Plant Development, Chels

BOT 510- Ecology and Environment

UNIT 1(0.5 Credit)

1. Historical perspectives, Population concepts: Characteristics, dynamics and control

2. Vegetation organization and characteristics: Concepts of community and continuum; community coefficients, interspecific associations, ordination; ecological niche;

UNIT 2(1.0 Credit)

3. species diversity (α , β , γ)

4. Ecological succession: Models and mechanisms of ecological succession; changes in ecosystem properties during succession

5. Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); decomposition (mechanism, controlling factors);

UNIT 3(0.5 Credit)

6. Ecosystem nutrient cycles(carbon, nitrogen and sulphur), Ecosystem stability: Concept (resistance and resilience); ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion

UNIT 4(0.5 Credit)

7. Biological diversity: Concept and levels; distribution and global patterns; terrestrial biodiversity hot spots; role of biodiversity in ecosystem functions; IUCN categories of threat; inventory; conservation, protected area network

.

UNIT 5(0.5 Credit)

8. Environmental pollution: Kinds, sources, effects on plants and ecosystems
9. Global change: Greenhouse gases, consequences of climate change; ozone layer depletion, causes

Practicals

1. To determine the minimum size of the quadrat by species area curve method.
2. To study the communities by quadrat method and to determine % frequency, Density, and Abundance.
3. To determine the Biomass of a particular area
4. To determine the amount of dissolved oxygen in pond water
5. To determine the total dissolved solids and chlorides in water.
6. Estimation of salinity of water samples

References- R.S Ambasht 1976. A textbook of plant ecology.,
E.P Odum 1983, Basic ecology, E.J Kormondy 1986, concepts of ecology
R.H Whittaker 1975, communities and ecosystem

BOT511-Biostatistics (3.0 Credit)

1. General concepts and term, concepts of biostatistics
2. Sampling methods
3. Measures of location, scale and shape
4. Contingency tables and chi-square test
5. Comparison of means: t-test, multiple range tests
6. Simple experimental design and analysis of variance
7. Correlation and regression analysis
8. Introduction to multivariate methods

Practicals- To be decided during class work.

References

- P.K gupta1992, Biostatistics,P.S verma1990,Biostatistics (Third Edition). Jones and B. Artlet Publisher, Inc., London.
11. **Russel, P.J.** 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
 12. **Snustad, D.P and Simmons, M.J** 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
 13. **Gardner and Simmons Snustad**2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
 14. **Sariu C** 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.

BOT 512 – Genetics and Plant Breeding

UNIT 1(0.5 Credit)

1. – Introduction to mendelian and post mendelian genetics with historical perspectives , gene interaction, epistasis, lethal genes.

2.- Cytoplasmic inheritance: -

Cytoplasmic inheritance involving chloroplast (*Mirabilis jalapa*, *Zea mays*) and Mitochondria (petite yeasts and cytoplasmic male sterility in higher plants), mitochondrial and chloroplast genomes, interaction between nuclear and cytoplasmic genes. (Rubisco and Cytochrome oxidase)

UNIT 2(0.5 Credit)

3. Quantitative Inheritance : -

Qualitative and Quantitative traits, Continuous variation, Inheritance of quantitative traits, (corolla length in *Nicotiana*, cob length in *Zea mays*), multiple factors hypothesis and heritability.

4. Recombination and Linkage: -

Concept of Linkage, Types and Applications, Concept and Types of Recombination, estimation of recombination percentages and map distances, Gene mapping in Fungi using ordered and unordered tetrads of *Neurospora* and yeast. Three point test crosses and estimation of linkage distances in plants. Gene maps and physical maps.

UNIT 3(0.5 Credit)

5. Population genetics: -

Gene and genotype frequencies, Hardy-Weinberg law, Factors affecting Hardy-Weinberg equilibrium (selection, mutation, migration and genetic drift).

UNIT 4(0.5 Credit)

6. Cytogenetics: -

Karyotype, chromosome markers, Variation in chromosome structure – Detection, Duplication, Inversion and Translocation. Cytological consequences of crossing over in Inversion and translocation heterozygotes.

7. Polyploidy: -

Classification, Aneuploidy, Euploidy, and its importance, Methods of inducing Auto and allopolyploidy, Role of polyploidy in crop improvement.

UNIT 5(1.0 Credit)

(12

8. Plant Breeding: -

Pre and post Mendelian development, objectives, Genetic basis of breeding, Plant breeding in India.

9. Plant Genetic resources: -

Genetic diversity in plants, Importance of genetic diversity in crop improvement and its erosion, Concepts of biodiversity conservation and regulation.

10. Reproductive systems and Pollination control mechanisms: -

Sexual reproduction (Cross and self pollination), Incompatibility and Male sterility, their types, mechanisms and applications in plant breeding.

11. Hybridization: -

Hybridization and its role, Inter-varietal and wide crosses. Principles of combination breeding and its application. Hybrid breeding in self and cross pollinated crops. Heterosis, Inbreeding depression.

12. Mutations: -

Concepts, classification of mutation, physical and chemical mutagens, their mechanism of action, molecular basis of gene mutations, Role of mutations in Plant Breeding.

Practicals

1. Mathematical problems based on Mendelian genetics (Test of goodness of fit),
2. Induction of polyploidy using colchicine; preparation of C-metaphase and karyotyping
3. Effect of physical/chemical mutagens on early seedling growth (Germination) and isolation of chlorophyll mutants following irradiation and treatment with chemical mutagens.
4. Study of meiosis in complex translocation heterozygotes (*Rhoeo discolor*)
5. Study of quantitative inheritance in suitable plant material.

References: -

1. **Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter** 1989, Molecular Biology of the Cell (Second Edition) Garland Publishing Inc, New York.
2. **Atherly, A.G., Girton, J.R. and McDonald, J.F** 1999. The Science of Genetics Saunders College Publishing, Frot Worth, USA.
3. **Burnham, C.R** 1962. Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
4. **Busch, H. and Rothblum. L** 1982. Volume X. The Cell Nucleus rDNA part A. Academic Press.
5. **Hartk D.L and Jones, E.W** 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts, USA.
6. **Khush, G.S** 1973. Cytogenetics of Aneuploids. Academic Press, New York, London.
7. **Karp, G.** 1999. Cell and Molecular Biology : Concept and Experiments. John Wiley and Sons, Inc., USA.
8. **Lewin, B.** 2000. Gene VII. Oxford University Press, New York, USA.
9. **Lewis, R.** 1997. Human Genetics : Concepts and Application (Second Edition). WCB McGraw Hill, USA.
10. **Malacinski, G.M and Freifelder, D.** 1998 : Essentials of Molecular Biology (Third Edition). Jones and B. Artlet Publisher, Inc., London.
11. **Russel, P.J.** 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
12. **Snustad, D.P and Simmons, M.J** 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
13. **Gardner and Simmons Snustad**2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
14. **Sariu C** 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.

BOT 513- Plant diversity and Resource Utilization

Unit 1 (1.0 Credit)

1. Concept of centres of origin, their importance with reference to Vavilov's work; examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

Cereals

2. Wheat and Rice, Role of dwarf varieties in green revolution; brief account of millets and pseudocereals.

3. Legumes General account, importance to man and ecosystem; chief pulses grown in India.

UNIT 2(1.0 Credit)

4. Fruits

Mango, Citrus, Papaya.

5. Sugars and starches

Ratooning and nobilization of sugarcane, products and by products of sugarcane industry; Potato (Tuber anatomy and propagation methods) and comparative account with cassava.

6. Spices Listing of important spices, their family and part used; with special reference to fennel, saffron, clove, turmeric and all spices; common adulterants of spices.

7. Beverages

Tea, coffee and cocoa, their processing and some common adulterants.

UNIT

8. Oils and Fats

General description with details of groundnut, coconut, linseed and *Brassica* spp and their use related health implications.

9. Essential Oils

General account and comparison with fatty oils.

UNIT 4(1.0 Credit)

(6 Lectures

)

10. Natural Rubber

Para Rubber, tapping and processing, Various substitutes of Para Rubber.

11. Drug Yielding Plants

Therapeutic and habit forming drugs with special reference to *Cinchona*, *Digitalis*, *Rauwolfia*, *Papaver* and *Cannabis*.

12. Masticatories and Fumitories

Tobacco and Health hazards.

UNIT 5

13. Timber plants

General account with special reference to teak and pine.

14. Fibres

Classification based on the origin of fibres, Tetraploid cotton and jute.

PRACTICALS

Study of the following through habit sketches temporary preparations, permanent slides, photographs

specimens products microchemical tests etc. to bring out the economic

importance: **Cereals:** Wheat, Rice, Millets and Pseudo cereals; **Legumes:**

Soyabean, groundnut and gram, **Fruits:** mango, citrus and

papaya; **Sugars and starches:** sugarcane, potato, cassava; **Spices:** black pepper, coriander, fennel;

Beverages: tea, coffee, cocoa; **Oils and Fats:** Coconut, mustard and linseed

Essential-oil yielding

plants: *Rosa, Cymbopogon, Vetiveria, Santalum and Eucalyptus*; **Fiber-yielding**

plants: *Gossypium,*

Corchorus, jute; **Woods:** *Tectona, Pinus* **Rubber:** *Hevea brasiliensis*; **Drug**

yielding plants:

Cinchona, Digitalis, Rauwolfia, Papaver, Cannabis; **Fumitory plants:** Tobacco

Each student should submit a theoretical project on any one of the topic pertaining to the course content.

Some of the suggested topics for this purpose are: Biofuels; Biocides; Newer drug plants; Germplasm

conservation; IPR, MTA; Heterosis; Selection methods of breeding; Conventional and non conventional

plant breeding methods, GM crops, Quarantine Practices in a botanical conservation.

In

References

Takhtajan, A 1997, diversity and classification of flowering plants, Kochhar, S.L 1998, Economic botany in the tropics. B. Choudhary 1992 Vegetables, Wicken Hill, A 1976, A.V.S Sambamurty 1989 Economic botany

BOT 514 -Plant pathology

UNIT 1(1.0 Credit)

1. Historical and developmental aspect of plant pathology
2. Mode of infection and role of enzymes and toxins in plant diseases
3. Defense mechanisms of plants against infections: Preexisting structural and chemical defense, induced structural and chemical defense, hypersensitive reactions, role of phytoalexin and other phenolic compounds.

UNIT 2 (0.5 Credit)

4. Management of plant diseases; cultural, chemical and biological, biopesticides, breeding of resistant varieties, plant quarantine, integrated pest management
5. Post harvest technology: fungal deterioration of food commodities, mycotoxins and health hazards, control measures.

UNIT 3(0.5 Credit)

6. Molecular plant pathology:molecular aspect of host pathogen interaction-PR proteins, Degradation of phytoalexins, systemic resistance mechanism; application of molecular biology to plant disease control- transgenic approach to crop protection.

UNIT 4(0.5 Credit)

7. Various plant diseases- wart disease of potato, blight of colocasia, downy mildew of cucurbits, stem gall of coriander, peach leaf curl, ergot of bajra, smut of sugarcane, karnal bunt of wheat, linseed rust, tikka disease of groundnut, red rot of sugarcane, panama disease of banana, bacterial blight of rice, leaf curl of tomato,

UNIT 5(0.5 Credit)

(6Lectures)

8. yellow vein mosaic of bhindi, mosaic of sugarcane, potato spindle tuber mosaic, ear cockle of wheat, grassy shoot of sugarcane, phylloidy of sesamum, citrus greening

practicals

1. identification of plant diseases in materials provided
2. various methods of disease control measures and its application

References– Agrios(1978), plant pathology, Mehrotra R.S(1980).
Plant pathology, Mundkur,B.B (1961) fungi and plant disease

BOT 515 - Plant cell and Tissue culture

UNIT 1(0.5 Credit)

1. Historical perspectives
2. Principles of plant tissue culture: Organization of laboratory, media composition and preparation, aseptic manipulation.

UNIT 2(0.5 Credit)

3. Cellular totipotency
4. Somatic embryogenesis: induction and controlling factors
5. Organogenesis: process and controlling factors

UNIT 3(1.0 Credit)

6. Haploids: androgenic and gynogenic
7. Somatic hybridization: isolation, culture and fusion of protoplasts; regeneration of hybrids and cybrids
8. Clonal propagation: Micropropagation.

UNIT 4(5Lectures)

- 9.Somaclonal and gametoclonal variation and their selection
10. Transgenic plants: methods of transformation, Selection and identification.

UNIT 5(1.0 Credit)

11. Germplasm conservation and synthetic seed technology
Industrial application. 12.

PRACTICALS:

1. Preparation of different types of standard tissue culture media.
2. Establishment of aseptic cultures following appropriate sterilization procedures using seeds.
3. Preparation of competent cells and *Agrobacterium* transformation by electroporation.
4. *Agrobacterium tumefaciens*-mediated transformation of tobacco.
5. Visualization of GFP or YFP in transgenic *Arabidopsis*.
6. Morphological and histochemical features of major cereals, oilseeds, legumes, forest trees, non-alcoholic beverages and medicinal plants.
7. Analysis of crude extracts from medicinal plants using HPLC.
8. Evaluation of a transgenic phenotype (viz., Herbicide resistance) under containment conditions in the field.

References- D.A Evans, W.R Sharp 1983, Handbook of plant cell culture
Elsevier, Amsterdam .plant tissue culture 1983
P.R white 1943 , A hand book of plant tissue culture
E.W sinnott 1960 .plant morphogenesis
H.E Street 1974, tissue culture and plant science

BOT 516 - Cytogenetics and plant breeding

UNIT 1 (0.5 Credit)

1. Introduction to cytogenetics. Meiotic and mitotic division

Meiosis: modes of meiosis, Chromosome disjunction. Genetic control of meiosis, Mechanism and theories of crossing over, Recombination models, synaptonemal complex

UNIT 2 (1.0 Credit)

2. Structural variation in Chromosome, their cytological consequences, Gene mapping and uses, structural hybrids, B- Chromosome origin and consequences. Numerical variation in chromosome, Sources and consequences of euploidy and aneuploidy, Natural and induced polyploids

UNIT 3.(1.0 Credit)

3. Genome analysis in crop plants: Wheat, Cotton, Tobacco, Triticale. Alien genetic resources in crop improvement: Alien addition and substitution lines, Transfer of segment from alien chromosome, possibilities and limitations.

UNIT 4.(0.5 Credit)

Apomixis; Types of apomixes, Sources of apomixes, Distribution of Apomixis, Identification of Apomixis and Regulation of Apomixis in higher plant and its relevance in plant breeding.

Practical

1. Smear Preparation in *Allium cepa*, *Zea mays*, *Delphinium*
2. Meiotic analysis in plants at pachytene level
3. Study of aneuploidy and chromosome mapping.
4. Cytological analysis of polyploidy in plants.
5. Genome analysis in Wheat/*Gossypium*
6. Study of apomictic chromosome.

References

Khush G.S 1973 Cytogenetics of aneuploids, Burnham C.R 1962 Discussion in cytogenetics, Harti D.L and Jones, Karp G, P.K Gupta, Prasad G., Swaminathan M.S 1987 Cytogenetics of crop plants, Swanson C.P Mertz T. and Young 1973 Cytogenetics

BOT 517- Environmental management

UNIT 1 (1.0 Credit)

1. Man as a biological species in the ecosystem; population increase; carrying capacity, exploitation of resources due to activities like agriculture, horticulture, urbanization and industrialization.

2. Public awareness of Environment issues:

Role of Government, NGO's, International organizations, treaties and conventions. Environmental movements.

3. Natural resources:

Land, Water, Air, Bioresources and biodiversity.

UNIT 2

4. Effect of human activities:

Depletion of resources; Generation of waste; types (agricultural, municipal, industrial); management of wastes and disposal (emphasis on concepts of reduce, reuse and recycle); Pollution of air, water, soil, noise, and due to radioactive substances; causes and methods of prevention and control; Eutrophication;

bioremediation; Depletion of forests; threats to biodiversity, extinction of species.

UNIT 3 (1.5 Credit)

5. Sustainable Development:

Definition; Brundlandt Report; Threats to sustainable development, green technologies, eco-cities, Ecological footprint, National Environmental Policy.

6. Energy:

Conventional Fuel – wood, fossil fuels; Non-conventional or alternate sources - sun, wind, bioenergy, geothermal, ocean, hydrogen, nuclear.

UNIT 4

7. Conservation of natural resources

Soil – Contour farming, afforestation and reforestation; Water – Rainwater harvesting, aquifers , groundwater recharge, watershed management; Biodiversity – In-situ conservation (Sanctuaries, National Parks, Biosphere Reserves, World Heritage Sites), Project Tiger and other conservation efforts. RS and GIS in natural resource management.

social forestry and Joint forestry Management; ex-situ conservation (botanical gardens, gene banks, cryopreservation); role of organizations like NBPGR, BSI, ZSI, WWF, IUCN and conventions like- Convention on Biological diversity; Ramsar Convention, National Action Plan on Conservation of Biodiversity; Environmental laws and acts.

UNIT 5 (0.5 Credit)

8. Global environment change:

Greenhouse effect and global warming; climate change; shrinking of glaciers and polar ice caps and consequent effects on river and sea levels; ozone layer depletion; vegetation and biota; international

efforts to control these effects (Vienna Convention, Montreal Protocol, UNFCCC, Kyoto Protocol, Copenhagen Summit, etc.); IPCC; Biosafety of GMOs and LMOs

9. Environmental impact assessment

Concept, aim and steps.

Practicals 1. Surveying and data collection

2. Virtual lab work based on the data provided.

References Bhatta 2008. Remote sensing and GIS
W, Benzoni 1990, Desktop mapping
Campbell J.B, 1996, Introduction to remote sensing

BOT 518- Microbial genetics and Biotechnology

UNIT 1 (1.0 Credit)

1. Tools of microbial genetics: Bacteriophages (T4, lambda, Mu), *Neurospora crassa*
2. Mutation: Spontaneous and induced mutation, mutagens and their effects on DNA structure and protein synthesis

UNIT 2 (0.5 Credit)

3. Genetic recombination: Homologous recombination, site specific recombination and transposition
4. Regulation of genome activity: Signal transmission, changes in genome activity, regulation of genome activity during development

UNIT 3 (0.5 Credit)

5. Gene expression and regulation: Lactose and Tryptophan operon, Regulation of virulence genes in pathogenic bacteria, heat shock regulon, SOS regulon and Cps regulon
6. Cell signalling: Communication between cell and environment with special reference to nutrients (N and P) and temperature

UNIT 4 (0.5 Credit)

7. Bacterial associations in plants: perception and signalling
8. Microbial toxins: Types, biochemical and molecular basis of toxins production, mode of action

UNIT 5(0.5 Credit)

9. Gene manipulation for production of novel commercial products: biopolymers and antibiotics

PRACTICALS:

1. Determination of colony forming units (CFUs) using haemocytometer, dimensions of microbes using ocular- and stage-micrometer.
2. Differential staining of bacteria using Gram-stain; Endospore staining using Malachite Green; Methods for measurement of bacterial growth.
3. Isolation and estimation of bacterial proteins; Study of amylase and protease activity in bacteria.
4. Estimation of phosphate solubilizing capacity of microorganisms; Characterization of Plant Growth Promoting Rhizobacteria – Production of ammonia, IAA, siderophores, HCN, antibiotics, antifungal metabolites.
5. Isolation of *Rhizobium* from root nodules.
6. Isolation, identification and enumeration of AM fungal spores from soil.
7. Isolation of bacterial nucleic acids from soil to study microbial diversity of unculturables.

References

1. Prescott L, Harley J, Klein D (2005) Microbiology, 6th edition, McGraw-Hill.
2. Singh VP and Stapleton RD (Eds.) (2002) Biotransformations: Bioremediation Technology for Health and Environmental Protection. "Progress in Industrial Microbiology Vol. 36", Elsevier Science.

3. SubbaRao NS (1982) *Advances in Agriculture Microbiology*, Butterworth-Heinemann.
4. SubbaRao NS and Dommergues YR (Eds.) (2001) *Microbial Interactions in Agriculture*

BOT 519- Angiosperms

UNIT1 (1.0 Credit)

1. Systematics: Historical perspectives. Outline of classification of Angiosperms; Bentham and Hooker, Hutchinson, Takhtajan, Cronquist, merits and Demerits

UNIT2

2. Botanical nomenclature: International code of Botanic Nomenclature; principles: Rules and recommendations; priority; typification; Rules of effective and valid publications; retention and choice of names

UNIT3 (1.0 Credit)

3. Taxonomic features, systematic phylogeny and economic importance of families: Magnoliaceae, Capparidaceae, Combretaceae, Rosaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Verbenaceae, Polygonaceae, Euphorbiaceae, Orchidaceae, Zingiberaceae, Araceae, Cyperaceae and Poaceae

UNIT4 (1.0 Credit)

4. Numerical taxonomy: Aims and objectives, characters and attributes, OTUs, coding, cluster analysis,
5. Chemotaxonomy: Role of phytochemicals (non-protein amino acids, alkaloids, betalins, cyanogenicglucosides, silica, gypsum, raphides, glucosinolate, flavonoids, terpenoids) in taxonomy

UNIT5

6. Biosystematics: concepts; biosystematic categories; methods in experimental taxonomy
7. Embryology in relation to taxonomy
8. Molecular approaches to plant taxonomy: Application of DNA markers in angiosperm taxonomy; molecular phylogeny

Practicals

Angiosperms: -

1. Methods of non-destructive field collection and documentation.
2. Techniques of herbaria preparation.
3. Morphological characterization of selected families of dicots (10 families) and monocots (5 families) and identification upto families.
4. Preparation of artificial key (at least five) based on appropriate character combination.
5. Identification of genus and species from – (at least ten)
Monocots and Dicots

References: -

1. Blatter E and W.S Millard. 1929. Some Beautiful Indian Trees J.Bom. Nat Hist Soc. 2:624-635.
3. Bor N.L 1943. Manual of Indian Forest Botany. London.
4. Clifford H.T and W. Stephenson. 1975. An Introduction to Numerical Taxonomy. Academic Press, N.Y.
5. Cole A.J (Ed.) 1969. Numerical Taxonomy. Academic Press,N.Y.
6. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd. London

