



GULBARGA UNIVERSITY
GULBARGA

DEPARTMENT OF P.G. STUDIES AND RESEARCH IN BOTANY

M. Sc. Botany Syllabus (CBCS) – Effective from Academic year 2011-2012 and onwards

SEMESTER I

Hard Core Theory

BOt: HCT. 1.1 Viruses, Bacteria, Algae and Fungi

BOt: HCT. 1.2 Bryophytes, Pteridophytes and Gymnosperms

BOt: HCT. 1.3 Plant Systematics and Economic Botany

Soft Core Theory

BOt: SCT. 1.4.1 Ecology and Environment

BOt: SCT. 1.4.2 Phytogeography and Evolution

Hard Core Practical

BOt: HCP. 1.5 Viruses, Bacteria, Algae and Fungi

BOt: HCP. 1.6 Bryophytes, Pteridophytes and Gymnosperms

BOt: HCP. 1.7 Plant Systematics and Economic Botany

Soft Core Practical

BOt: SCP. 1.8.1 Ecology and Environment

BOt: SCP. 1.8.2 Phytogeography and Evolution

BOT: HCT. 1.1 Viruses, Bacteria, Algae and Fungi

52 hours

Unit-I

Viruses: Classification, properties and nomenclature; ultra structure (TMV & Bacteriophage); infection and multiplication of Phage (Lytic cycle); Viral diseases: TMV, YBMV and Papaya Ring Spot Virus (PRSV), Viroids and Prions.

Mycoplasma: Ultra structure and classification; symptoms caused by MLOs; Sandal spike, little leaf of *Vinca rosea*, grassy shoot of sugar cane.

Unit-II

Bacteria: Ultra-structure of Bacterial cell; Reproduction: fission and genetic recombination (transformation, transduction and conjugation); role of Bacteria in agriculture and nitrogen fixation; Bacterial diseases: Citrus canker, Black arm of Cotton. Bacterial plasmids and their characteristics.

Unit-III

Introduction and history of Phycology with special reference to Indian work.
Algae - Origin and classification. Algal pigments, plastids, flagella, pyrenoids, eyespot.

A general account, thallus organization, reproduction and life cycle in *Cyanophyta*, *Chlorophyta*, *Xanthophyta*, *Bacillariophyta*, *Phaeophyta* and *Rhodophyta*. Economic importance of Algae.

Unit-IV

Fungi: General Characteristics and classification ; fungal cell structure. Structure and reproduction in *Plasmodiophora*, *Synchytrium*, *Saprolegnia*, *Sclerospora*, *Rhizopus*, *Phyllactinia*, *Xylaria*, *Puccinia*, *Ustilago*, *Lycoperdon*, *Alternaria*, *Cercospora*, *Colletotrichum* and *Sclerotium*. Role of fungi in agriculture and medicine.

References:

1. Hans, G. Schlegel 1993. General Microbiology.
2. Alexopoulos, C. J. 1963. Introductory Mycology.
3. Ainsworth, C. G. *et al.*, 1973. The fungi - an advance treatise Vol. 1,2,4 (A&B).
4. Rangaswami, G. 1998. Diseases of crop plants in India.
5. Webster, J. Introduction to Fungi
6. Smith, G. M. Cryptogamic Botany Vol. 1.
7. Bisby, G, R. An introduction to the Taxonomy and Nomenclature of fungi.
8. Smith, K. M. 1977. Plant viruses.
9. Mathews 1981 Plant viruses.
10. Bilgrami K. S. and L. S. Saha (1992): A text book of algae.
11. Round F. E. (1973): The biology of algae
12. Fritch F. E. (1935 & 1945): Structure and reproduction of algae (Vol. I & II)

13. Chapman V. J and Chapman D. J. (1973): The algae.
14. Smith G. M. (1955): Cryptogamic Botany.
15. Fogg G. E. (1987): The metabolism of algae.
16. Prescott G. M. (1969): The algae-A review.
17. Tilden Josephine (19990): The algae and their life relationship
18. Palmer C. M. (1977): Algae and water pollution

BOT: HCT. 1.2 Bryophytes, Pteridophytes and Gymnosperms

52 hours

Unit-I

Bryophytes – origin, general account and classification. Economic and Ecological importance. Structure, reproduction and life cycle in - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales and Polytrichales.

Unit-II

Pteridophytes - Introduction, classification and distribution.

Psilopsida: Comparative account of Psilophytales and Psilotales.

Lycopsidea: Vegetative habits and reproductive features with references to Lepidodendrales, Lycopodiales and Isoetales.

Unit-III

Stelar evolution in Pteridophytes, Economic importance of Pteridophytes.

Heterospory and Seed habit.

Sphenopsida: Vegetative habits and reproductive features with reference to Sphenophyllales and Calamitales.

Pteropsida: Vegetative habits, anatomy, sori and sporangia in ferns.

Unit-IV

Gymnosperms - Introduction and classification. Morphology, Anatomy and Reproduction in Cycadales: (*Cycas* and *Zamia*), Ginkgoales: *Ginkgo biloba*, Coniferales: (*Pinus* and *Araucaria*), Gnetales: (*Gnetum* and *Ephedra*). Economic importance of Gymnosperms.

References:

1. Campbell, D. H. (1905). The Structure and Development of Mosses and Ferns.
2. Campbell D. H. (1990): The evolution of land plants: origin of land flora.
3. Bower, F. O. (1935): Primitive Land Plants.
4. Kato and Akiyama (2005): Origin of sporophyte of land plants.
5. Frans Verdoorn (1932): Manual of bryology.
6. Smith G. M. (19380): Cryptogamic Botany Vol-II & Bryophytes and Pteridophytes.
7. Parihar, N. S. (1965): An Introduction to Embryophyta. Vol. I. Bryophyta.
8. Watson V. (1971): Structure and life of Bryophytes.
9. Russel T. H. (1990): Moss and Liverworts.
10. Andrews, H. N. (1961): Studies in Paleobotany, Wiley, N. Y.
11. Arnold, C. A. (1947): An introduction to Paleobotany, McGraw Hill, N. Y.
12. Bhatnagar, S. P. and Alok, M. (1996): Gymnosperms, New Age, Delhi.
13. Bold, H. C., Alexopoulos, C. J. and Delevoryas, T. (1980): Morphology of plants and fungi, Harper and Row, N. Y.
14. Bierhost (1971): Morphology of vascular plants, MacMillan, New York.
15. Biswas, C. and Johri, B. M. (1997): The Gymnosperms, Narosa, Delhi.

16. Chamberlain, C. J. (1935): *Gymnosperms-Structure and evolution*, Chicago Univ. Press, Chicago.
17. Datta, S. C. (1973): *An introduction to Gymnosperms*, Asia Publ. House, Bombay.
18. Foster, A. S. and Gifford, Jr E. M. (1974): *Comparative morphology of Vascular plants*, Freeman, Sanfransisco.
19. Parihar, N. S. (1977): *The Biology and Morphology of Pteridophytes*, CBD, Allahabad.
20. Rashid, A. (1986): *An introduction to Pteridophytes*, Vikas, New Delhi.
21. Sporne, K. R. (1970): *Morphology of Pteridophytes*, Hutchinson Univ, London.
22. Sporne, K. R. (1969): *Morphology of Gymnosperms*, Hutchinson Univ, London.
23. Walton, J. (1953): *An introduction to the study of fossil plants*.

BOT: HCT. 1.3 Plant Systematics and Economic Botany

52 Hours

UNIT-I

A general account of - root system, stem, leaf, inflorescence, flower, pollination, fertilization, seed and fruit.

Herbaria and their importance. Preparation of herbarium specimens.

Brief account on the herbaria of world and India. Botanical gardens of world and India.

Importance of Botanical gardens. Botanical Survey of India.

UNIT-II

Taxonomy: Pre-Darwinian, Post Darwinian and Phylogenetic systems of classification (Cronquist, Takhtajan and Thorne).

ICBN - Principles, priority, valid publication and effective publication, citation.

ICNCP, Classification of cultivated plant species, documentation and registration of cultivated plants.

UNIT-III

Taxonomic study of Ranunculaceae, Magnoliaceae, Polygalaceae, Caryophyllaceae, Rubiaceae, Meliaceae, Lythraceae, Cactaceae, Rhizophoraceae, Oleaceae, Aristalochaceae, Asclepiadaceae, Casuarinaceae, Dioscoriaceae, Bignoniaceae, Solanaceae, Lauraceae, Loranthaceae, Euphorbiaceae, Arecaceae, Typhaceae and Poaceae.

Unit-IV

Economic Botany: Food crops : Three examples each for cereals, millets, legumes and tropical fruits. Sugar yielding crops, Spices, Beverage plants, Timbers and pulp yielding plants. Rubber yielding plants, Fiber yielding plants and Oil yielding plants. Minor forest products – resins, gums and tannins.

References:

1. Airy-show, H.K. 1983. Eighth edition. A dictionary of flowering plants and ferns, Cambridge Uni. Press.
2. Bennet, S.S.R. 1979. An introduction to plant nomenclature, International Book Distributors, Dehradun.
3. Cronquist, A. 1968. The evolution and classification of flowering plants, Thomas Nelson and Sons Ltd. London.
4. Jeffery, C. 1982. Sec. Edn. An introduction to plant taxonomy, Cambridge Uni. Press.
5. Jhori, B.M. and Bhatnagar, S. P. 1994. Taxonomy of Angiosperms. Narosa Publishers, New Delhi.
6. Jones, S. B. and Luchsinger, A. E. 1979. Plant Systematics McGrew Hill Book Co. N. Y.
7. Kochhar, S. L. 1998. Economic Botany in the tropics, Mac Millen - Ltd. Delhi.

8. Lawrence, G. H. M. 1951. Taxonomy of vascular plants. Mac Millen, London.
9. Naik. N. 1984. Taxonomy of Angiosperms.
10. Krishnamurthy K. V. (2003). An Advance Text Book on Biodiversity. Oxford and IBH publishing Comp. Pvt. Ltd. New Delhi
11. Hill,A.F. 1952. Economic Botany. 2nd Ed. New York, McGraw Hill.
12. S. L. Kochhar, 1998 2nd Ed, Economic Botany in the Tropics. Macmillan India Ltd, New Delhi.
13. Sambamurthy, A. V. S. S. and Subramanium, N. S. Economic Botany Wiley Eastern Ltd. New Delhi

BOT: SCT. 1.4.1 Ecology and Environment

52 Hours

Unit - I

Ecosystem: Concept and components, trophic structure.
Productivity: Primary production, measurement of primary productivity.
Energy Flow in ecosystems.
Biogeochemical cycles: Water, Carbon, Nitrogen, Sulphur and Phosphorus

Unit - II

Communities: Classification, Structure and Characteristics (Analytic and Synthetic)
Plant succession: Views and types. Climatic climax.
Genecology: Concepts, ecotypes and ecads.

Unit - III

Soil: Formation, profile and properties. Soil erosion and conservation.
Plant interaction: Competition, Allelopathy.
Water bodies and their classification.
Method and importance of rain water harvest.

Unit - IV

Remote sensing: Application in hydrology and vegetation analysis.
Pollution: Air, Water and Land (Sources of pollutants and their effects on plants).
Green house effect and ozone depletion.
Aerobiology and its importance, monitoring of airborne particles.

References:

1. Odum, E.P. 1971. Fundamentals of Ecology.
2. Robert Leo. Smith 1980. Elements of Ecology and field Biology.
3. Kormondy, E.J. 1989. Concepts of Ecology.
4. Hanson, H.C. and E.D. Churchill, The Plant community.
5. Clements F.E. Plant Succession.
6. Brij Gopal and N. Bhardwaj Elements of Ecology.
7. Sharma, P.D. 1999. Ecology and Environment.
8. Ambasht, R.S. and Ambasht, N.K.1999. A Text book of plant Ecology.
9. Microbiology of the atmosphere, by P.h. Gregory.

BOT: SCT. 1.4.2 Phytogeography and Evolution

Unit - I

Phytogeographical regions of the World. India : Western Himalaya, Eastern Himalaya, Indus plane, Gangetic sub-mountain zone, Temperate zone, Alpine zone. General characters of flora of India. Native taxa, naturalization of exotic taxa.

Floristics: Floristic study of the world and India.

Continental drift: A general account, tectonic movements, disjunct distribution, dispersal, migration and endemics.

Unit-II

Type of Vegetation distribution in India and Karnataka. Phytogeography of Hyderabad Karnataka area. Major plant communities.

Unit-III

Darwin and origin of species, models of speciation- Allopatric speciation, Sympatric speciation, Stasipatric speciation. Isolating mechanism and rate of speciation. Genetic variation-inbreeding depression, protein polymorphism, variation in nucleotide sequences. Formation of species.

Unit-IV

Evolution of sex in plants-Asexual reproduction, origin and evolution of sex organs, alternation of generations. Parthenogenesis and its applications.

References

1. Walter's Vegetation of the Earth: Ecological Systems of the Geo-Biosphere (4th Edition) by Heinrich Walter, Siegmund-Walter Breckle. Paperback - October 2002
2. Plant geography by George Simonds Boulger (Jan 1, 1912)
3. Edible Wild Plants of the Prairie: An Ethnobotanical Guide by Kelly Kindscher (1987)
4. Advanced Plant Geography Author:Shiv Manikant Dube. 2011 Swastik Publications. ISBN 789381084700
5. Textbook of the Plant Geography of India. by F.R. Bharucha ISBN: 0195612620 ISBN-13: 9780195612622

Practicals

BOT: HCP. 1.5 Viruses, Bacteria, Algae and Fungi

Unit-I

1. Preparation of stains and fixatives.
2. Study of morphological and reproductive structures of fungi .
3. Staining of Bacteria: gram staining.
4. Collection and study of algae, identification using monographs.
5. Culturing algae in laboratory and their growth measurements.

Unit-II

6. Structure and reproductive features of *Oscillatoria*, *Spirogyra*, *Chara*, *Sargassum*, *Polysiphonia*
7. Demonstration of motility in Bacteria.
8. Determination of microbial counts using Haemocytometer.
9. Isolation of fungi from soil: media preparation, dilution plate technique.

NOTE: Every student has to submit 5 specimens / herbaria at the time of practical examination in addition to a certified practical record.

BOT: HCP. 1.6 Bryophytes, Pteridophytes and Gymnosperms

Unit-I

1. Collection, Preservation and Identification of Bryophytes (minimum 2 genera from each group).
2. Thallus Structure, anatomy and reproductive features of *Riccia*, *Anthoceros*, *Funaria*, and *Polytrichum*
3. Habit, anatomy and reproductive features of *Psilotum*, *Lycopodium*, *Isoetes*, *Equisetum*, *Ophioglossum* and *Osmunda*

Unit-II

4. Habit, anatomy and reproductive features of *Pteris*, *Ceretopteris*, *Hymenophyllum*, *Marselia*, *Salvinia* and *Azolla*.
5. Habit, anatomy and reproductive features of *Zamia*, *Ginkgo*, *Araucaria*, *Podocarpus*, *Agathis*, *Ephedra* and *Gnetum*.
6. Types of fossils and fossiliferous rocks.
7. Study of available fossil specimens and slides of Pteridophytes and Gymnosperms

Note: Submission of herbarium (05)

BOT: HCP. 1.7 Plant Systematics and Economic Botany

Unit-I

1. Description of plants using technical terms
2. Identification of plants to family level.
3. Identification of plants to species level using flora

4. Preparation of Dichotomous key for identification
5. Listing of endangered species

Unit-II

6. Study of locally available economically important plant products.
7. Map indicating the origin of crop plants.
8. Preparation of herbarium of locally available plants.
9. Extraction of essential oil using Clevenger's apparatus.
10. Estimation of carbohydrates in cereals and proteins in pulses.

Note: Submission of 5 herbarium / photographs of plant specimens during Practical Examination

BOT: SCP. 1.8.1 Ecology and Environment

Unit-I

1. Determination of leaf area by Planimeter method
2. Determination of available soil moisture by Moisture meter.
3. Determination of stomatal index
4. Determination of organic content of soil.
5. Determination of Soil pH using pH meter.

Unit-II

6. Determination of DO in water.
7. Determination of minimum size of the quadrat by species area curve method.
8. Study frequency of herbaceous plants by applying law of frequency.
9. Study plant abundance and density by quadrat method.
10. Meteorological instruments and their working principles.

BOT: SCP. 1.8.2 Phyto-geography and Evolution

Unit-I

1. Floristic regions of India.
2. Evolutionary concepts
3. Drawing maps of continental drift

Unit-II

4. Listing plants of GUG campus
5. Listing of wild edible plants and
6. Listing of medicinal plants and their uses in Gulbarga area.
7. Studying species distribution and its measurements
8. Examples of exotic / invasive species

Note: Submission of 5 maps / photographs / herbaria during practical Examination Botanical Study Tour of about seven days is compulsory during the First semester.

SEMESTER II

Hard Core Theory

BOT: HCT. 2.1 Plant Anatomy and Embryology

BOT: HCT. 2.2 Cell Biology and Genetics

Soft Core Theory

BOT: SCT. 2.3.1 Microbial Technology

BOT: SCT. 2.3.2 Plant breeding and Propagation

Open Elective Theory

BOT: OET. 2.4. Biofertilizers and Biopesticides

Hard Core Practical

BOT: HCP. 2.5 Plant Anatomy and Embryology

BOT: HCP. 2.6 Cell Biology and Genetics

Soft Core Practical

BOT: SCP. 2.7.1 Microbial Technology

BOT: SCP. 2.7.2 Plant breeding and Propagation

Open Elective Practical

BOt: OEP. 2.8 Biofertilizers and Biopesticides

BOT: HCT. 2.1 Plant Anatomy and Embryology

52 Hours

Unit-I

Introduction and History, Primary and Secondary cell walls, Ultra Structure and Chemistry of Cell Wall

Cambium: General account. Xylem, ontogeny, Phylogeny, Evolution, ultra Structure and function. Phloem ontogeny, symplast and apoplast, phylogeny, Evolution Ultra Structure of Sieve tube elements and functions.

Unit-II

Wood Anatomy, Softwood, Hard wood, Ring and Diffuse porous wood, Xylem parenchyma, Ray system, Anomalous Primary Structure and Secondary growth with reference to following: *Nyctanthus*, *Acyranthus*, *Boerhavia*, *Leptadinia*, *Piper*.

Embryology: Introduction, History

Male gametophyte: Microsporogenesis, Tapetum; types and functions, Sporopollinin, Pollen structure, pollen Allergy

Female gametophyte: Brief Introduction to Embryo sac development (No type studies). Organization of Mature Embryo sac, Ultra Structure of Egg apparatus, Nutrition of Embryo sac.

Unit-III

Pollination: Brief account, Structure, Histo-chemical details of style and Stigma, Pollen germination, pollen embryo sac. Self incompatibility

Fertilization: Path of entry of pollen tube, Site of pollen discharge. Double fertilization.

Unit-IV

Endosperm: Types of endosperm development, Endosperm haustoria, Endosperm culture & function.

Embryogenesis: Monocot and dicot embryo development; Physiology and genetics of Embryo development, Somatic embryogenesis.

References:

Anatomy

1. Clegg, CJ and Cox, G. (1974) Anatomy and Activities of Plants- A guide to the study of flowering Plants.
2. Cutler, D. F. (1978) Applied Plant Anatomy, Longman, New York.
3. Cutter E. Plant Anatomy: Experiments and interpretation. Part-1. Cells and Tissues. Edward, Arnold, London.(1969)
4. Cutter, E. Plant Anatomy: Experiments and Interpretation. Part-2. Organs. Edward, Arnold, London. (1971)

5. Eames E. J. and McDaniel's (1947). An introduction to plant anatomy. Mc Grew Hill, New York and London.
6. Esau, K. (1960) Anatomy of seed plants. John Wiley and Sons.
7. Esau, K. (1965) Plant Anatomy 2nd Edition.
8. Esau, K. (1965) Vascular differentiation. Hort, Rinehart and Winston, New York.
9. Fahn, A. (1974) Plant Anatomy 2nd Edition, Pregmon.
10. Krishnamurthy, K. V. methods in Plant Histo-Chemistry. Vishwanathan, S Madras, 1988.
11. Roy, K. (2006) Plant Anatomy, New Central Book Agency (P) Limited, Calcutta.

Embryology:

1. Maheshwari P. (1950). An introduction to Embryology of angiosperms. McGrew Hill, New York.
2. Bhojwani S. S. and Bhavnagar S. P. (2000). The embryology of Angiosperms (4th revised and enlarged edition) Vikas Publishing house, New Delhi.
3. Raghavan V. (1997). Molecular embryology of flowering plants. Cambridge University press, Cambridge.
4. Raghavan V. (1986). Embryogenesis in angiosperms- A developmental and experimental studies. Cambridge University Press New York USA.
5. Raghavan V. (1987). Molecular Biology of flowering plants Cambridge University Press New York USA.
6. Shivanna K. R. and Sawhney V. K. (eds) 1997. Pollen Biotechnology for crop production and improvement. Cambridge University, Cambridge.

BOT: HCT. 2.2 Cell Biology and Genetics

52 hours

Unit-I

Cell: Structure and functions of lysosome, ER, ribosome, plastids, Golgi bodies. Biogenesis of mitochondria and chloroplast. Cytoskeletons and cell movements- Microtubules, microfilaments and intermediate elements, motor proteins

Cell cycle- Regulation of CDK-cyclin activities, molecular basis of cellular check points, DNA replication in prokaryotes and eukaryotes. Enzymes of DNA replication, proof reading and error correction, DNA damage and repair.

Unit-II

Chromosome: Organization of chromatin – euchromatin and heterochromatin, constitutive and facultative heterochromatin, rearrangement, repetitive and non- repetitive DNA, C-value paradox, transposable elements. Nucleosome model, structure and organization of telomere, centromere and kinetochore. Cytological and molecular basis of crossing over, Chromosome mapping.

Unit-III

Mendelism: Pre Mendelian, Mendelian and Post Mendelian genetics. Complementary, epistasis, inhibitory, lethal and additive interaction of genes. Molecular basis for mendelism. Discovery of genetic material.

Sex determination: Chromosomal theory of sex determination, hormonal influence on sex differentiation. Dosage compensation, sex-linked inheritance, sex determination in plants.

Cytoplasmic inheritance: 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-IV

Population Genetics: Population and gene pools, Hardy-Weinberg's law, Factors effecting allelic frequencies in population- Mutation, Migration, Nonrandom mating, Selection, Random genetic drift.

Human genome: Human genome project, Genetic disorders, Genetic testing, Gene therapy, clinical genetics, prenatal diagnosis, genetic counseling, ethical issues.

References:

1. Cell Biology: Smith and Wood
2. Cell Biology: C. B. Pawar
3. Cell and Molecular Biology; Lewin, J. Klein smith and Valerie M Kish

4. Cell and Molecular Biology-Concept and Experiments 2nd Ed: Gerald Karp
5. Cell and Molecular Biology (1999). Gupta P. K. Rastogi Publication Meerut India
6. Concept of Genetics 4th Ed: William S Klung and M R Cummings
7. Genetics MW Strickberger
8. Principles of Genetics: Sinnott and Don
9. Cell and Molecular Biology: P K Gupta
10. Understanding GENETICS- A molecular approach: Norman V Rothwell
11. Genetics- Analysis and Principles: Robert J Brooker
12. Genetics 4th Ed: Susan Elrod and William Stan field
13. The Human Genome; R Scott Hawiey and Catherine and Mori
14. Principles of Genetics: D Peter Snustad et al.
15. Genetics: Daniel L Hartl.
16. Genomes: T A Brown
17. Cell Biology: De Robertis
18. Principles of genetics – Sinnott, Dunne & Dobzhansky

BOT: SCT. 2.3.1 Microbial Technology

52 hours

Unit-I

Methods of studying Microorganisms: Isolation, identification, stains and staining techniques, cultivation and preservation of microbes (fungi & bacteria).
Methods of sterilization : Sterilization by heat, filtration and radiation.
Chemical disinfectants, their advantages and limitations.

Unit-II

Microbes in agriculture: Factors influencing soil microbial population. Biofertilizers, Mass production of phosphate solubilizing bacteria, BGA and Mycorrhizae.
Microbes in dairy: Pasteurization, sterilization of milk, fermented dairy products.
Microbes in food: Food spoilage and toxins. Edible mushrooms and their cultivation.

Unit-III

Microbes in industry: Production of organic compounds- ethanol, acetone, citric acid, lactic acid, amino acids. Microbial enzymes-amylase, protease, pectinase and lipase production. Production of antibiotics and nano-particles from microbes.

Unit-IV

Algae in human nutrition: Macro-organisms: *Gracilaria*, *Laminaria*, *Sargassum*, *Porphyra*, Microorganisms (SCP: *Scenedesmus* and *Spirulina*). Nutritional value of SCP.
Microbiology of water- Potability, quality assessment, contaminants-Biotic and abiotic.

References:

1. Biotechnology-Food Fermentation Vol. I : V K Joshi and Ashok Pandey
2. Micro bio logy- A Human perspective: Eugene W Nester et al.
3. Modern Food Microbiology 6th Ed: James M Jay
4. Microbiology Technology: Rajni Gupta and K G Mukerji
5. Text Book of Microbiology 6 Ed: A Ananthnarayana and C K J Paniker
6. Food Microbiology: Doyle, Beuchat and Montville
7. Microbiology-An introduction 3rd Ed: Tortora, Funke and Case
8. General Microbiology: Powan and Daninawala
9. Advances in General Microbiology: Sharad Shrivastava and Vineet Singhal
10. Industrial Microbiology 4th Ed.: Prescott and Dunn's
11. Manual of Environmental Microbiology 2nd Ed.; Christen J Hurst and others
12. Industrial Microbiology: A H Patel
13. Waste Water Microbiology 2nd Ed.: G Bitton
14. Environmental Biotechnology: S N Jogdand
15. Industrial Microbiology: Agrawal and Parihar
16. Agriculture Biotechnology: Rangaswami and Bagyaraj.
17. Amos Richmond (2004): Handbook of microalgal culture: Biotechnology and Applied Phycology.

18. Cresswell R. C., Rees T.A. V. and Nishith Shah (1989): Algal and cyanobacterial biotechnology.
19. Das, Mihir Kumar (2010): Algal Biotechnology New Vistas.
20. Michael A. Borowitzka (1988): Micro-algal biotechnology.
21. Wolfgang Becker E. (1994): Microalgae: Biotechnology and Microbiology.

BOT SCT. 2.3.2 Plant Breeding and Propagation

Unit-I

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding. Plant breeding techniques - Breeding methods in self pollinated, cross pollinated, vegetatively propagated and apomictic plants. Evolution in crop Plants and centers of crop origin.

Unit-II

Selection and hybridization, emasculation, mass selection, pure line selection, bulk method and pedigree method of selections. Backcross method of breeding and their merits and demerits.

Unit-III

Inbreeding depression - Role of heterosis and hybrid vigour in plant breeding. Heterosis; male sterility and self incompatibility – their significance. Somaclonal variation in crop improvement. RFLP in plant breeding.

Unit-IV

Introduction to the principles, techniques, and facilities used to propagate Crop Plants and ornamental plants. Seed propagation, cuttings, grafting, budding, division, layering, and tissue culture.

References:

1. Plant Propagation by Alan Toogood.
2. Plant Propagation: Principles and Practices, Hartman and Kester.
3. Complete Book of Plant Propagation (97)
C. W. Heuser, R. Bird, M. Honour, C. Innes, J. Arbury and M. Salmon (Hardback | ISBN10: 1561582344; ISBN13: 9781561582341)
4. Hartmann, Kester, Davies, and Geneve, 2011. *Hartmann and Kester's Plant Propagation: Principles and Practices*. Eighth edition. Prentice-Hall, Inc. Publishing, Upper Saddle, NJ. ISBN: 978-0-13-501449-3.
5. Principles of Plant Breeding. Robert Wayne Allard. John Wiley and Sons, 10-May-1999 - Science - 254 pages
6. Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches by G.S. Chahal and S.S. Gosal . ISBN-10: 084931321X | ISBN-13: 978-0849313219
7. Singh, B. D. (1983). Plant Breeding principles and methods Ludhiana Kalyani Publications. Dew Delhi/Hyderabad

BOT: OET. 2.4 Biofertilizers and Biopesticides

52 Hours

Unit-I

Biofertilizers – Definition, Classification, Advantages and Constraints. Role of biofertilizers in modern agriculture. Bacterial biofertilizers - A general account of *Azospirillum*, *Azotobacter*, *Frankia*, *Phosphobacteria* and *Rhizobium*. Mass production of *Azospirillum*, *Azotobacter* and *Phosphobacteria*.

Unit-II

Cyanobacteria (BGA) as biofertilizers - A general account of *Anabaena*, *Cylindrospermum*, *Gloeocapsa*, *Lyngbya*, *Nostoc*, *Plectonema* and *Tolypothrix*. Symbiotic association of Cyanobacteria. Field application of Cyanobacterial inoculants. *Azolla* as biofertilizer.

Unit-III

Mycorrhizae as biofertilizers - A general account and applications of mycorrhizae. Methods of collection, wet sieving and decanting method and inoculum production. Culturing of mycorrhizae in Modified Melin - Norkrans (MMN) agar medium. Applications of Mycorrhizae. *Trichoderma* as biofertilizer.

Unit- IV

Biopesticides - Uses and limitations of Biopesticides and their application. Advantages over chemical pesticides. Biocontrol of plant diseases. Cross protection. Fungal and Bacterial Biopesticides – *Trichoderma*, *Bacillus thuringiensis*. Bioinsecticides – Insecticidal plants (Neem and others). Virus, bacteria and fungi as insecticides.

References

1. Dubey, R. C. (2008): A Textbook of Biotechnology. S. Chand & Co., New Delhi.
2. Newton, W. E. *et al.* (1977): Recent Developments in Nitrogen Fixation. Academic Press, New York.
3. Schwintzer, C. R. and Tjepkema, J. D. (1990): The Biology of *Frankia* and *Actinorhizal* Plants. Academic Press Inc., San Diego, USA.
4. Stewart W. D. P. and Gallon J. R. 1980): Nitrogen Fixation. Academic Press, New York.
5. Subba Rao, N. S. (1982): Advances in Agricultural Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Subba Rao, N. S. (2002): Soil Microbiology. 4th ed. Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Subba Rao, N. S. and Dommergues, Y. R. (1998): Microbial Interactions in Agriculture and Forestry. Vol. I, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

8. Verma, A. (1999): Mycorrhiza. Springer Verlag, Berlin.
9. Wallanda, T. *et al.* (1997). Mycorrhizae. Backley's Publishers, The Netherlands.
10. Ilan chet (Ed.). Innovative Approaches to plant disease Control. Wiley Inter Science Publication, Ihon Wiley and Sons New York (1987)
11. Agrios, G. N. Plant Pathology, Fourth Edition 1997, Academic Press, U S A.

Practicals:

BOT: HCP. 2.5 Plant Anatomy and Embryology

Unit-I

1. Preparation of Fixatives and Stains
2. Preparation of double stained permanent slides.
3. Preparation and Identification of Transverse Section of the following plants: *Tridax procumbens*, *Boerhaavia diffusa*, *Bougainvillea spectabilis*, *Achyranthes aspera*, *Nyctanthus arbo-terrestris*, *Leptadinia reticulata*, *Calotropis procera*, *Aristolochia indica*, *Tinospora cordifolia*, *Salvadora persica*.
4. Preparation and identification based on T.S, T.L.S and RLS sections of the following wood *Michelia champaka*, *Dalbargia sisoo*, *Tectona grandis* (Teak), *Azadriachta indica* (Neem), *Achras sapota* (Sapota), *Mangifera indic* and *Tecoma stans*.
5. Epidermal studies

Unit-II

6. Preparation of Microtome sections and staining procedures
7. Identification of different developmental stages of Embryo sac.
8. Identification of different developmental stages of Anther.
9. Histo-chemical staining for: Cellulose, Callose, Chitin, PAS reaction and Lignin.

Note: Submission of 10 permanent slides

BOT: HCP. 2.6 Cell Biology and genetics

Unit-I

1. Preparations of fixatives and stains
2. Mitotic and meiotic divisions
3. Micrometry in chromosomal studies
4. Structural and numerical changes induced by EMS and Colchicine

Unit-II

5. Genetic problems
6. Preparation of Polytene chromosomes
7. Barr body staining
8. Karyotypes

BOT: SCP. 2.7.1 Microbial Technology

Unit-I

1. Isolation of bacteria, fungi and actinomycetes
2. Production of Citric acid
3. Extraction and Chromatographic separation of Aflatoxin
4. Estimation of extracellular amylase activity

5. Estimation of extracellular protease activity

Unit-II

6. Sterilization methods
7. Demonstration of microbial antagonism
8. Isolation of Rhizobium and VAM.
9. Isolation of Cyanobacteria.
10. Determination of Spore concentration (Haemocytometer)
11. Phytoplankton sampling and Identification.

Bot SCT. 2.7.2 Plant Breeding and Propagation

Unit -I

1. Study of Gynoecium and Androecium of selected crop plants
2. Emasculation, hand pollination
3. Protoplast isolation and fusion
4. Noting of superior traits

Unit - II

1. Tissue culture of pollen and ovary
2. Study and listing of parthenogenic fruits
3. Callus culture and synthetic seeds
4. Pollen pistil interaction – compatibility and incompatibility factors

BOT: OEP. 3.8 Biofertilizers and Biopesticides

Unit-I

1. Isolation and culturing of Cyanobacteria (BGA)- *Anabaena*, *Cylindrospermum*, *Gloeocapsa*, *Lyngbya*, *Nostoc*, *Plectonema* and *Tolypothrix*.
2. Cultivation of *Azolla*
3. Isolation of Nitrogen fixing bacteria - *Azobacter* and *Azospirillum*
4. Demonstration and isolation of root nodules (*Rhizobium*)

Unit-II

5. Isolation and identification of fungal and insect biocontrol agents
6. Isolation and culturing of *Aspergillus*, *Trichoderma* and *Bacillus* sps.
7. Experiments on Fungal and bacterial Antagonism
8. Trap crops, mixed crops and crop rotation in Gulbarga Region

SEMESTER III

Hard Core Theory

BOT: HCT. 3.1 Plant Physiology

BOT: HCT. 3.2 Molecular Biology

Soft Core Theory

BOT: SCT. 3.3.1 Methods in Plant Sciences

BOT: SCT. 3.3.2 Genetic engineering

Open Elective Theory

BOT: OET. 3.4 Medicinal Plants

Hard Core Practical

BOT: HCP. 3.5 Plant Physiology

BOT: HCP. 3.6 Molecular Biology

Soft Core Practical

BOT: SCP. 3.7.1 Methods in Plant Sciences

BOT: SCP. 3.7.2 Genetic Engineering

Open Elective Practical

BOT: OEP. 3.8 Medicinal Plants

BOT: HCT. 3.1 Plant Physiology

52 Hours

Unit - I

Amino acids, Proteins and Enzymes-Structure of amino acids and proteins. Enzymes- Nomenclature and properties. Extraction and purification of enzymes.

Carbohydrates and Lipids: Properties and classification, Synthesis and degradation of Sucrose; Biosynthesis and oxidation of fatty acids; Conversion of lipids to carbohydrates in germinating seeds.

Unit - II

Plant growth hormones: Biosynthesis, metabolism, transport and physiological effects of Ethylene and Abscisic acid. A brief account of commercial applications of growth hormones.

Membranes: Structure and organization; Transport across membranes- passive and active transport processes.

Unit - III

Photosynthesis: Mechanisms of electron and proton transport processes. Photophosphorylation and ATP synthesis. Calvin, and Hatch-Slack cycles; Crassulacean acid metabolism in plants, Photorespiration.

Respiration: Overview of plant respiration. Glycolysis, Krebs' cycle, Electron transport, Oxidative phosphorylation and ATP synthesis.

Unit - IV

Nitrogen metabolism and fixation: Assimilation of Nitrate and Ammonium ions. Molecular mechanism of nitrogen fixation- the role of Leg hemoglobin, *nif* and *hup* genes.

Temporal organization: Characteristics of biological rhythms-biological clocks, Phytochrome-cellular location and action.

Stress physiology: Stressful environment, Mechanism of plant responses to Drought and Cold stresses.

References:

1. Plant physiology: Lincoln Taiz and Eduardo Zeiger: Sinaur Assoc. Inc. Sunderland Massachusetts 1998.
2. Cell Physiology and Biochemistry: Me Elroy W D: Prentice Hall of India, 1995.
3. Enzymatic reaction mechanisms: Walsh C T: W H Freeman, New York, 1979,
4. Physiology of ion transport across the tonoplast of higher plants: Birkla B J and Pantanjio O: Ann. Rev. Plant Physiology, 47, 159-184, 1996.

5. Plant membranes-Endo and plasma membranes of plant cells: Robinson D G: West Germany, 1985.
6. Transport in plants I. Phloem transport: Zimmermann M H and Milburn J A:
7. Encyclopedia of plant physiology, New series, 1, Springer, New York.
8. Electrogenic ion pumps: Spanswick R M: Ann. Rev. Plant Physiol. 32, 267-289, 1981.
9. Photosynthesis- physical mechanisms and chemical patterns: Clayton R K: Cambridge Univ. Press, 1992
10. Photosynthesis: Robinowitch E and Govindjee: Wiley, New York 1969.
11. Photorespiration protects C3 plants from photo-oxidation: Kozaki A and Takeba G: Nature, 384,557-560, 1996.
12. The Phytochrome chromophore I. Photomorphogenesis in plants: Rudier W and Thummlar K: Netherlands 51-69, 1994.
13. Applied radiobiology and radiation protection: Granier R and Gambini D J: Ellis Howard, 1990.

BOT: HCT. 3.2 Molecular Biology

52 Hours

Unit - I

Molecular Biology: Introduction, central dogma of molecular biology, significance. Gene concept, Fine structure of gene. Concept of split gene, discovery and nature of split genes, Split genes in Mitochondria and Chloroplasts, Hypothesis for the origin of mRNA introns. Overlapping gene, Pseudo gene and cryptic gene.

Genetic code: Contribution of Nirenberg and Khorana, properties of genetic code, Mitochondrial genetic code.

Unit - II

Regulation of gene expression in Prokaryotes and Eukaryotes: An Overview, Operon concept: Lactose metabolism (An inducible gene system) and tryptophan Operon (repressible system) in *E. coli*. Transcription - Promoters, Enhancer, transcription factors, transcription termination and anti - termination. DNA methylation, RNA processing - Capping, polyadenylation, splicing-spliceosome and ribozyme. Translation- Structure and composition of ribosomes in prokaryotes and eukaryotes, Role of RNA in protein synthesis, RNA polymerases.

Unit - III

Transposable elements: Eukaryotic transposons - Ac-Ds system in Maize, P-elements in *Drosophila* and Retro-elements. Transposable elements in man. Prokaryotic transposons - Insertion and composite sequences, Applications of transposons in research and health care system.

Mutation: Molecular basis of spontaneous and induced mutations and their role in evolution.

Unit- IV

Gene and immunity: Natural and acquired immunity, Immune responses-humoral and cell mediated immunity, antibody structure, antibody genes, immune system malfunctions.

Genes and Cancer: Genetic control of cell cycle, molecular basis of cancer, tumor suppressor genes, oncogenes, prevention, detection and treatment of cancer.

References:

1. Cell Biology: Smith and Wood
2. Cell and Molecular Biology: Lewin J Klein smith and Valerie M Kish
3. Cell and Molecular Biology- Concept and Experiments 2nd Ed: Gerald Karp
4. Genetics: Denial J Fairbanks
5. Concept of Genetics 4th Ed: William S Klung and M R Cummings

6. Genetics: MW Stritckberger
7. Cell and Molecular Biology: P K Gupta
8. Understanding GENETICS- A molecular approach. Norman V Rothwell
9. Molecular Genetics: G S Stent
10. Genetics- Analysis and Principles: Robert J Brooker
11. Genetics 4th Ed: Susan Elrod and William Stan field
12. The Human Genome: R Scott Hawley and Catherine and Mori
13. Gene: Benjamin Lewin
14. Principles of Genetics: D Peter Snustad et al.
15. Genetics: Daniel L Hartl.
16. Genomes: T A Brown
17. Cell Biology: D Robertis
18. Molecular Biology of Gene: J P Watson

Bot: SCT. 3.3.1 Methods in Plant Sciences

Unit – I

Microscopy : Micrometry, different types of microscopes & their working.

Microbial Techniques : Sterilization methods, Fungal and bacterial stains, isolation from soil, air, water and other substrates. Dilution plate technique, Culture media, single spore isolation.

Aerobiological techniques : spore sampling techniques - slides, petriplates, vertical cylinder, Anderson sampler, Burkard spore trap.

Unit – II

Chromatography: Principle, Classification of Chromatographic methods, Paper Chromatography, Thin layer Chromatography (TLC), Column Chromatography, Gas Chromatography, High performance Liquid Chromatography – Application of Chromatography.

Centrifugations: Introduction, Centripetal & Centrifugal force; Factors affecting Sedimentation, Sedimentation coefficient and Sedimentation constant, different types of Centrifuges.

Unit – III

pH & pH Meters: Introduction, Glass electrode, Reference electrode, Combination Electrode, working of PH meter

Electrophoresis: Introduction, Principles, Component of an Electrophoresis Unit, Factors affecting Electrophoretic mobility, Support medium Buffers, Detection & assay, Recording & storing, Different types of Electrophoresis and their applications

Unit – IV

Spectroscopy: Introduction, Principle of Beer- Lamberts Law, Colorimetry & Spectrophotometry, ultra violet and visible spectroscopy (UV-VIS) Flame photometry, Spectroscopy.

Polymerase Chain Reaction: Principle and working mechanism. The cycling reactions, constraints in PCR, Inverse PCR, RT-PCR, Real time PCR, - Applications of PCR techniques.

Nuclear Magnetic Resonance (NMR), Mass Spectrometry (MS), Infra- Red Spectrometry (IR) and Flow cytometry.

References:

1. Birren B. E. *et al.*, (2006): Genome Analysis – A Laboratory manual Vol.-I: Analyzing DNA. Panima Publishing House (reprinted) New Delhi/Bangalore.
2. Bold. R. W., and Primerose, S. B. Principles of gene manipulation- An introduction to genetic engineering. Black Well Scientific Publications. London, Edinburg, Boscon,

3. Introduction to plant Biotechnology Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Datta, A. (2009). Experimental Biology-A Laboratory Manual. Narosa Publishing house New Delhi.
5. Gurumani, N. (2006). Research methodology for Biological Sciences M.J.P.
6. Marimuthu, R. (2011). Microscopy and microtechniques.
7. Pratibha Devi (2000). Principles and Methods of plants molecular Biology, Biochemistry and Genetics. Agrobios (India).
8. Purohit S.D. (2007). Molecular Biology and Biotechnology-A practical manual. Apex Publishing house, Udaipur/Jaipur
9. Rick Wood D and Hames B. D. (1990). Gel electrophoresis of Nucleic acid – A practical approach. III edition IRL presses Oxford. New York.
10. Shukla, Y. M. Dhruve, J. J. Patel. N. J. Bhatnagar, R. Talati, J. G. and Kathiria K. B. (2009). Plant Secondary Metabolites New India Publishing House New Delhi.
11. Veera kumari, (2006). Bioinstrumentation MJP Publication.
12. P. H. Gregery. Microbiology of Atmosphere (2 Ed.) Leonard Hill Books 24 market Square, Aylesbury, Bucks (1961)
13. C. T. Ingold. Fungal spores, their liberation and dispersal oxford University Press, London. (1971)
14. R. T. V. Fox. Principle of diagnostic techniques in plant pathology CAB International, Wallingford, UK. (1993).
15. K. R. Aneja. Experiments in microbiology, Plant Pathology and Tissue culture, Wiswa Prakashan, New Delhi, (1993)
16. V. N. Pathak. Laboratory Manual of Plant Pathology (2Ed.) Oxford and IBH Publishers, New Delhi (1984)

SCT 3.3.2 Genetic Engineering

52 Hours

Unit-I

R-DNA Technology: Introduction, Enzymes used in genetic engineering Nucleases : Restriction enzymes, (R E) Nomenclature of RE, Mode of Action of REs. DNA ligase, Kinase, Klenow fragment, Reverse transcriptase, Alkaline Phosphatases, Terminal Deoxynucleotide transferase, T4 Ligase.

Cloning Vectors: Plasmids; Nomenclature and Classification, PBR-322, PUC Plasmid Bacteriophages, Cosmids, Plasmids, Shuttle Vectors, Yeast episomal plasmid, Yeast replicating plasmid.

Unit-II

Blotting techniques: Introduction, Southern Blotting, Northern blotting, western blotting. DOT blotting techniques, Plaque/Colony blotting technique.

DNA Libraries: Construction of genomic library, c-DNA Library.

Unit-III

Polymerase Chain Reaction: Introduction, principle involved in PCR, components of PCR, basic reaction, different types of PCR (Inverse PCR, Anchored PCR, RT-PCR) Applications of PCR).

Molecular Markers: Restriction fragment length Polymorphism (RFLP), Amplified fragment length polymorphism (AFLP), Random Amplified Polymorphic DNA (RAPD), Simple sequence repeats (SSR)

Unit-IV

Gene Transfer Methods: 1. *Agrobacterium* mediated genetic transformation, 2. Transfer of genes using physical delivery methods; Poly ethylene glycol mediated DNA up take, Liposome mediated DNA uptake, Micro injection and Micro projectile bombardment method.

Trans genes and Transgenic plants: Marker genes; Reporter genes, (cat, gus, Luc, GFP) BT toxin gene, Proteinase inhibitor, Cowpea trypsin inhibitor.

References:

1. Bold. R. W., and Primerose, S. B. Principles of gene manipulation- An introduction to genetic engineering. Black Well Scientific Publications. London, Edinburg, Boscon,
2. Chawla, H. S. (2002). Introduction to plant Biotechnology Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Dixan. R. A. and Ganzales, R. A. (1994). Plant Cell Culture – A practical Approach. Oxford University Press New York.

4. Evans Et al., (1983). Hand Book of Plant Cell Culture. Vol.-I. Macmillan Publishing Co. New York.
5. Gamborg, O. L. and Phillips (1996). Plant Cell, Tissue and Organ Culture. Fundamental method, Narosa Publishing House New Delhi.
6. Gamborg. O. L. and Phillips, (1996). Plant cell. Tissue and Organ Culture Narosa Publishing House New Delhi.
7. Mukadam, U. Dawad, H. G. and Ratnaparkhi, S. (1997). Hairy root culture. Agro Botanica Bikaner, India.
8. Razdhan, M. K. (2003). Introduction to plant tissue culture 2nd edition: oxford and IBH Publishing Co. New Delhi.
9. Reinert, J and Bajaj, Y. P. S. (1988). Applied and Fundamental Aspects of PLANT CELL, TISSUE AND ORGAN CULTURE. Narosa Publishing house New Delhi.
10. Shukla, Y. M. Dhruve, J. J. Patel. N. J. Bhatnagar, R. Talati, J. G. and Kathiria K. B. (2009). Plant Secondary Metabolites New India Publishing House New Delhi.
11. Vasil, I. K. (1985). Cell culture and somatic cell genetics of plants vol.-II. Academic Press, INC. New York.

BOT: OET. 3.4 Medicinal Plants

52 Hours

Unit-I

Introduction: Medicinal plants, Ayurveda - Basic concepts, Tibetan system of medicine, Unani system of medicine, Siddha system of medicine, Medicinal plants in Homoeopathy system. Medicinal plants classification, Diseases of medicinal plants.

Unit-II

Medicinal value of food plants (only a couple of examples): cereals, pulses, spices, fruits, vegetables and wild food plants. Medicinal and nutritive values of mushrooms.

Unit-III

Herbal remedies: Plants used for treatment of heart and blood circulation, nervous disorders, respiratory and intestinal disorders, jaundice, urinary, skin, hair, diabetics, cancer, gynecological disorders and infertility. Plants used as general tonics.

Unit-IV

Ethno-botany and ethno-medicine: Importance of Ethno-botany and ethno-medicine in modern health care system, methods of collecting traditional knowledge on medicinal plants. Primary and secondary metabolites.

References:

1. Kirtikar K.R. and Basu, B. D. 1932. Indian Medicinal Plants.
2. 2 Nadkarni, A. K. 1954. Indian Materia Medica Vol. I & II.
3. Sivarajan, V.V. and Indira, B. 1994. Ayurvedic drugs and their plant sources. Oxford & IBH publishing Co., New Delhi
4. Trease, G, E. and Evans, W. L, 1983. Pharmacognosy 12th ed. Baillie Tindal, London
5. Vaidya, B, 1982. Some controversial drugs in Indian Medicine. Chaukamba Oriental, Varanasi
6. Harborne, J. 1984. Phytochemical methods. Ed Chapman & Hall, London
7. Mann, J., Davidson, R. S., Hobbs, J. B., Benthorpe, D. V, and Harborne Natural Products, Longman Scientific and Technical Co., Essex.
8. Smith, P.M 1976. The Chemotaxonomy of Plants. Edward Arnold, London.
9. Prajapati., Purohit., Sharma and Kumar. 2007. Hand Book of Medicinal Plants: A complete Source Book, Agrobios India.
10. Maheshwari, J. K. 2000. Ethno-botany and Medicinal Plants of Indian Subcontinent, Scientific Publishers, India.
11. Prajapati *et al.*, 2003. A Hand Book of Medicinal plants - A complete Source Book. Agrobios, Jodhpur, India.
12. Rastogi R. P. and Meharota B. N. 1991. Compendium of Medicinal Plants. Vol. I & II. 1993. CDIR, Locknow and publication and information directorate New Delhi India.

Practicals:

BOT: HCP. 3.5 Plant Physiology

Unit-I

1. Estimation of proteins in seeds by Lowry's method.
2. Estimation of the activity of lipase in seeds,
3. Quantitative estimation of carbohydrates by Benedict's and DNS method.
4. Estimation of total fat content in seeds
5. Demonstration of experiments on growth hormones.

Unit-II

6. Determination of water potential of tissue by plasmolytic / gravimetric method.
7. Quantitative estimation of calcium by EDTA method.
8. Study of Kranz anatomy in C₄ plant leaves.
9. Quantitative estimation of Chl a, Chl b and total chlorophyll in plant tissues.
10. Study of absorption spectrum of plant chlorophylls.
11. Determination of diurnal fluctuation in TAN of CAM plants.
12. Demonstration experiment on growth hormones/effect of red and far red light on seed germination.

BOT: HCP. 3.6 Molecular biology

Unit-I

1. Cultivation of *E.coli*
2. Isolation of DNA from prokaryotes
3. Isolation of DNA from eukaryotes
4. Quantification of DNA.
5. Electrophoretic separation of DNA.

Unit-II

6. Plasmid curing
7. Regulation of lac-operon genes
8. Quantification and Electrophoresis of RNA
9. Electrophoretic separation of enzymes/Protein

BOT: SCP. 3.7.1 Methods in Plant Sciences

Unit-I

1. Demonstration of sterilization methods
2. Isolation of bacteria and fungi from soil and plant parts
3. Demonstration of serial dilution technique

Unit-II

4. Plasmid culture

5. Demonstration of pH meter, UV-Visible spectra, Chromatography and PCR,
6. Chromatography – separation of pigments

BOT: SCP. 3.7.2 Genetic Engineering

Unit-I

1. Isolation of DNA from plants using CTAB method and quantification of DNA.
2. Isolation of plasmid DNA by alkali lysis method and its separation by electrophoresis.
3. Restriction digestion of DNA.

Unit-II

4. Amplification of DNA using PCR technique
5. Development of RAPD technique using random primers.
6. Genetic transformation using *Agrobacterium tumifaciens*.
7. Genetic transformation using *Agrobacterium rhizogenesis* and development of hairy roots.

BOT: OEP. 2.8 Medicinal Plants

Unit-I

1. Collection and identification of medicinal plants
2. Qualitative analysis of primary and secondary metabolites

Unit-II

3. Estimation of flavonoids
4. Estimation of phenol
5. Separation of secondary metabolites (TLC)
6. Pharmacological and Pharmacognostic analysis of crud plant drug

SEMESTER IV

Hard Core Theory

BOT: HCT. 4.1 Plant Pathology and Plant Protection

BOT: HCT. 4.2 Plant Biotechnology

Hard Core Major Project (HCMP)

BOT: HCMP. 4.3 Hard Core Major Project

Soft Core Theory

BOT: SCT. 4.4.1 Medicinal and Aromatic Plants

BOT: SCT. 4.4.2 Biodiversity and Conservation

Hard Core Practical

BOT: HCP. 4.5 Plant Pathology and Plant Protection

BOT: HCP. 4.6 Plant Biotechnology

Soft Core Practical

BOT: SCT. 4.7.1 Medicinal and Aromatic Plants

BOT: SCT. 4.7.2 Biodiversity and Conservation

BOT: HCT. 4.1 Plant Pathology and Plant Protection

52 Hours

Unit - I

History and development of Plant Pathology
Disease concept in plants: Disease classification,
Causal factors - biotic and abiotic, disease diagnosis, Koch's postulates.
Defense Mechanism in plants: Structural and Biochemical.
Genetics of Host – Pathogen interaction: Gene to gene and polygene hypotheses.
Immune and hypersensitive reactions.

Unit - II

Epidemiology: Traditional and modern concepts of disease triangle, Role of host, pathogen and environment in disease development. Aerobiology in relation to Epidemiology. Methods of monitoring splash borne and airborne inoculum.

Unit - III

Methods of assessment of disease incidence and disease severity and estimation of yield loss. Study of plant diseases of major crops of Gulbarga region caused by fungi, bacteria, and viruses. (with reference to symptoms, etiology and control).

Unit - IV

Principles of plant disease control:
Regulatory Methods: Plant quarantine regulation, inspection and certification.
Physical Methods: Heat and cold treatment (Hot water, Hot air, Radiation treatment).
Cultural Methods: Crop rotation, Flooding, Solarization, trap crops.
Chemical Methods: Prophylactants and systemic chemicals. Methods of fungicide application. Seed and soil treatment. Control of post harvest diseases.
Biological Methods: Use of antagonistic microorganisms. VAM fungi and control of soil borne diseases. Cross protection.

References:

1. Agrios, G. N. Plant Pathology, Fourth Edition 1997, Academic Press, U S A.
2. Burdon: Diseases and Plant population biology. Cambridge University Press, Cambridge.
3. S. Nagarajan: Plant Disease Epidemiology. Oxford and IBH Publishing Co. New Delhi (1983).
4. M. S. Wolfe and C. E. Caten (Eds.) Population of Plant Pathogen Black well Scientific Publication. Oxford (1987).
5. Ilan chet (Ed.). Innovative Approaches to plant disease Control. Wiley Inter Science Publication, Ihon Wiley and Sons New York (1987)
6. S. A. Tarr. Principles of plant Pathology. MacMillan Publishers Ltd. London.
7. P. H. Gregery. Microbiology of Atmosphere (2 Ed.) Leonard Hill Books 24 market Square, Aylesbury, Bucks (1961)
8. C. T. Ingold. Funal spores, their liberation and dispersal oxford University Press, London. (1971)
9. R. T. V. Fox. Principle of diagnostic techniques in pant pathology CAB International, Wallingford, UK. (1993).

10. P. Ieffreies and T.W. Young. Inter-fungal parasitic relationship CAB International, Wallingford. UK. (1994).
11. K. R. Aneja. Experiments in microbiology, Plant Pathology and Tissue culture, Wiswa Prakashan, New Delhi, (1993)
12. V. N. Pathak. Laboratory Manual of Plant Pathology (2Ed.) Oxford and IBH Publishers, New Delhi (1984)
13. Rangaswamy, G. Diseases of Crop Plants in India, Prentice Hall, New Delhi, 1979.
14. R. S. Singh, Introduction to Principles of Plant pathology, Oxford and IBH New Delhi.
15. Wheeler, B.E.J. An Introduction to Plant diseases, John Wiley & Sons Ltd. U K. 1972.

BOT: HCT. 4.2 Plant Biotechnology

52 Hours

Unit - I

History of Plant tissue Culture: Concept of Totipotency, and development of tissue culture. Discovery and role of Auxins and Cytokinins.

Requirements for tissue culture: Basic laboratory organization, instruments and Equipment, General composition of Culture medium (Major & Minor Salts, Carbon source, Vitamins, growth regulators and other additives).

Concept of Cellular Totipotency: Totipotency of cell differentiation, de-differentiation callogenesis, organogenesis, Hormonal control of callogenesis and organogenesis

Unit - II

Clonal Propagation: Techniques multiplication by apical axillary, and adventitious shoots, rooting and acclimatization of plants transferred to soils.

Organ Culture: Meristum culture and Production of Virus free plants, Leaf, root, ovule, Embryo Culture, embryo rescue.

Haploid Culture: Anther and Pollen Culture pathways of pollen germination, use of haploids in Crop improvement.

Unit - III

Protoplast Culture and Somatic hybridization:

Isolation, purification and culture of Protoplasts

Somatic hybridization, Cybrids, Selection of hybrids, Applications and limitations.

Somatic Embryogenesis: Induction, maturation and germination, factors effecting Somatic embryogenesis. Physiological and Biochemical aspects of Somatic embryogenesis, Application, Artificial / Synthetic Seeds.

Unit - IV

Production of Secondary metabolites: Types of Secondary metabolites, formation and Storage in plants. Techniques of Selecting Cell lines with increased Secondary metabolites level. Elicitations, Hairy roots and Productions of Secondary metabolites. Factors determining accumulation of Secondary metabolites. Bio transformation using plant cell cultures.

Bioreactors: Concept, types and use in plant Cell Culture.

Germplasm Conservation: *in situ* and *ex-situ* principles, Conservation of germplasm, Cryopreservation; Techniques and applications.

Somaclonal variations: Variations in regenerated plants, chromosomal and genetic basis of Soma Clonal variations applications.

Techniques of *in vitro* production of salt, drought and diseases resistant plants. General applications of plant Cell, tissue and organ culture.

References:

1. Birren B. E. et al., (): Genome Analysis – A Laboratory manual Vol.-I: Analyzing DNA. Panima Publishing House (reprinted) New Delhi/Bangalore.
2. Bold. R. W., and Primerose, S. B. Principles of gene manipulation- An introduction to genetic engineering. Black Well Scientific Publications. London, Edinbarg, Boscon,
3. Chawla, H. S. (2002). Introduction to plant Biotechnology Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Dixan. R. A. and Ganzales, R. A. (1994). Plant Cell Culture – A practical Approach. Oxford University Press New York.
5. Evans Et al., (1983). Hand Book of Plant Cell Culture. Vol.-I. Macmillan Publishing Co. New York.
6. Gamborg, O. L. and Phillips (1996).Plant Cell, Tissue and Organ Culture. Fundamental method, Naraosa Publishing House New Delhi.
7. Gamborg. O. L. and Phillips, (1996). Plant cell. Tissue and Organ Culture Narosa Publishing House New Delhi.
8. Mukudam, U. Dawad, H. G. and Ratnaparkhi, S. (1997). Hairy toot culture. Agro Botanica Bikaner, India.
9. Razdhan, M. K. (2003). Introduction to plant tissue culture 2nd edition: oxford and IBH Publishing Co. New Delhi.
10. Reinert, J and Bajaj, Y. P. S. (1988). Applied and Fundamental Aspects of PLANT CELL, TISSUE AND ORGAN CULTURE. Narosa Publishing house New Delhi.
11. Vasil, I. K. (1985). Cell culture and somatic cell genetics of plants vol.-II. Academic Press, INC. New York.

BOT: HCMP. 4.3 HARD CORE MAJOR PROJECT

Hard Core Major Project (HCMP)

Note: Students will be assigned a project work (survey/ review/ research) and he / she will work on project during the IV semester period and submit a report on or before the commencement of theory examination. There will be a double valuation (external and internal) for the project report. (70 marks for project report and 30 marks for internal assessment). A separate *viva voce* with project work presentation will be held for 50 marks. It will be evaluated by the concerned guide, external examiner and the BOE chairman.

BOT: SCT. 4.4.1 Medicinal and Aromatic Plants

52 hours

Unit - I

Ethnobotany and Ethnomedicine: History and importance of Ethno-botany and ethno-medicine in modern health care system. Ethnomedicines of Hyderabad Karnataka Region.

Traditional systems of medicine: Basic concepts and development of Ayurveda, Tibetan system, Unani system and Siddha system of medicine. Medicinal plants classification.

Cryptogames as medicine: Properties and active compounds of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.

Unit - II

Method and preparation of herbal drugs for the treatment of; heart and blood disorders, Nervous disorders, respiratory and intestinal disorders, Jaundice, Urinary, skin, hair, diabetics, Cancer, Gynecological disorders and infertility. Plants used as general tonics

Medicinal food plants: Cereals, pulses, spices, fruits, vegetables and wild food plants. Medicinal and nutritive value of mushrooms.

Unit - III

Medicinal oils yielding plants: Regional distribution of aromatic and non-aromatic oil yielding plants. Use of vegetable oil as food, medicine and industry

Cultivation of medicinal and aromatic plants: Cultivation practices, diseases and methods of pest control, harvesting and storage of medicinal plants. Post-harvest care, deterioration and disintegration of active compound during storage (*Rauwolfia*, *Costus*, *Withania*, *Mentha*, *lemon grass*). Controversial drugs

Intellectual property right: IPR related to medicinal and aromatic plants.

Unit – IV

Pharmacognosy: Raw drug analysis, microscopic, macroscopic characteristics, preliminary chemical analysis (*Senna*, *Withania*, *Rauwolfia*).

Phytochemistry: Classification and properties of alkaloids, steroids, terpenoids, lectins, non-protein amino acids.

Crystallography: Principles and applications of MS, UV, IR, NMR spectral analysis.

References:

1. Kirtikar K.R. and Basu, B.D. 1932 Indian Medicinal Plants.
2. Nadkarni, A.K. 1954 Indian Materia Medica Vol I & II
3. Sivarajan, V.V. and Indira, B. 1994. Ayurvedic drugs and their plant sources. Oxford & IBH publishing Co, New Delhi.

4. Trease, G, E. and Evans, W.L. 1983. Pharmacognosy 12th ed. Bailliere Tindall, London.
5. Vaidya, B.1982. Some controversial drugs in Indian Medicine. Chaukamba Orientalia, Varanasi.
6. Harborne, J. 1984. Phytochemical Methods. Ed. Chapman & Hall, London
7. Mann, J., Davidson, R.S. Hobbs, J.B., Benthorpe, D.V. and Harborne Natural products, Longman Scientific and Technical Co, Essex.
8. Smith, P. M.1976. The chemotaxonomy of plants Edward Arnold, London.

BOT: SCT. 4.4.2 Biodiversity and Conservation

52 Hours

Unit-I

Species concept: Concept and importance of biodiversity, Earth summit 1992, and agenda 21, species diversity, genetic diversity, ecosystem diversity, Biodiversity of the world, India and Karnataka, Hotspots of world and India, Mega biodiversity centers of world and India. Origin centers of crop plants.

15 hrs

Unit-II

Loss of Biodiversity: Casual factors of threat, Impact of habitat loss and habitat fragmentation, Categories of treat endangered, vulnerable, rare, threatened and extinct. Red Data Book. Environmental impact assessment, sustainable development.

12 hrs

Unit-III

Biodiversity Conservation: Objectives, implication and action plans, International and National organizations for conservation of natural resources. *in situ* conservation – protected areas, biosphere reserves, national parks, sanctuaries and sacred groves. *ex situ* – conservation, botanical gardens, gene banks, medicinal conservation parks, herbal gardens.

12 hrs

Unit-IV

Biodiversity conservation Legal aspects: Legal aspects of biodiversity in India. Policy and priority setting. Biodiversity conservation future strategies for India. Biodiversity of Gulbarga region

13 hrs

References:

1. Heywood, V.M. and Watson, R.T. 1985. Global Biodiversity Assessment, Cambridge Univ. Press, Cambridge.
2. Swaminathan, M.N. & Jain, R.S. Biodiversity: Implications for global security, Macmillan, 1982.
3. CSIR 1986. The Useful Plants in India.
4. Kothari, 1987. Understanding biodiversity, life sustainability and equity, Orient Longman.
5. Richard B. Primack. 1993. Essentials of Conservation Biology.
6. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment.
7. Peter B. Kaufman et al., 1999. Natural Products from Plants.
8. Negi, S.S. 1993. Biodiversity and its Conservation in India.
9. Glasson, J., Therivel, R. & Chadwick, A. 1995. - Introduction to environment impact assessment. UCL Press Ltd., London.
10. Heywood, V.H. & Wyse Jackson, R.S. (eds.), 1991. - Tropical Botanical Gardens- their role in conservation and development. Academic Press, San Diego.
11. Nayar, M.P. 1996. - Hot spots of endemic plants of India, Nepal, and Bhutan. TBGRI, Trivandrum.

12. Nayar, M.P. & Sastry, A.R.K. 1987, 1989, 1990. - Red Data Book of Indian Plants (3 vols.).
13. Walter, K.S. & Gillett, H.J. 1998. - IUCN Red List of threatened plants. The World Conservation Union, Cambridge.

Practicals

BOT: HCP. 4.1 Plant Pathology and Plant Protection

Unit-I

1. Study of locally available diseases
2. Preparation of herbarium of disease specimens
3. Study of Koch's postulations
4. Assessment affected leaf area by Stover's method.
5. Field visits to assess disease incidence and severity

Unit-II

6. Estimation per cent of spore germination
7. Experiment to show fungicidal inhibition of spore germination
8. Spore traps
9. Isolation of fungi from disease plants / parts

BOT: HCP. 4.2 Plant Biotechnology

Unit-I

1. Preparation of medium, autoclaving and sterilization techniques.
2. Sterilization of plants material and induction of callus.
3. Induction of organogenesis and whole plants
4. Initiation of somatic embryogenesis and production of synthetic seeds/artificial seeds.

Unit-II

5. Isolation of protoplasts and culture
6. Induction and estimation of secondary plants products
7. Induction of suspension cultures.

BOT: SCP. 4.4.1 Medicinal and Aromatic Plants

Unit-I

1. Identification of medicinal plants
2. Extraction of plant extract (Soxhlet)
3. Preliminary tests for the occurrence of secondary metabolites

Unit-II

4. Separation of Alkaloids (TLC)
5. Estimation of Phenols
6. Estimation of essential oils
7. Identification of raw drugs - Pharmacognostic studies.
8. Identification of controversial drugs.

BOT: SCP. 4.4.2 Biodiversity and Conservation

Unit-II

1. Field survey of important plants of the region.
2. Study of the characters and threatened plants included in the theory.
3. Survey of important timber yielding trees of the region.
4. Determination of the minimum size of the quadrat suitable for an area using 'species area curve' method.

Unit-I

5. Determination of Importance Value Index (IVI) of the plant species in the community by quadrant method.
6. Study of Phytogeographic maps of world and India.
7. Map of Hot spots, Continental drift.
8. Study of Endangered plants species of Gulbarga region.

**SCHEME OF EXAMINATION OF M. Sc. DEGREE COURSE IN BOTANY UNDER
CBCS SEMESTER SCHEME 2011-12**

Semester	Paper No.	Title of the Paper	Theory / Practicals	Internal Assessment	Total Marks
First	Hard Core Theory				
	Bot:HCT.1.1	Viruses, Bacteria, Algae and Fungi	80	20	100
	Bot:HCT.1.2	Bryophytes, Pteridophytes and Gymnosperms	80	20	100
	Bot:HCT.1.3	Plant Systematics and Economic Botany	80	20	100
	Soft Core Theory				
	Bot:SCT.1.4.1	Ecology and Environment	80	20	100
	Bot:SCT.1.4.2	Phytogeography and evolution	80	20	100
	Hard Core Practical				
	Bot:HCP.1.5	Viruses, Bacteria, Algae and Fungi	40	10	50
	Bot:HCP.1.6	Bryophytes, Pteridophytes and Gymnosperms	40	10	50
	Bot:HCP.1.7	Plant Systematics and Economic Botany	40	10	50
	Soft Core Practical				
	Bot:SCP.1.8.1	Ecology and Environment	40	10	50
Bot:SCP.1.8.2	Phytogeography and evolution	40	10	50	
Second	Hard Core Theory				
	Bot:HCT.2.1	Plant Anatomy and Embryology	80	20	100
	Bot:HCT.2.2	Cell Biology and Genetics	80	20	100
	Soft Core Theory				
	Bot: SCT.2.3.1	Microbial Technology	80	20	100
	Bot:SCT.2.3.2	Plant Breeding and Propagation	80	20	100
	Open Elective Theory				
	Bot:OET.2.4	Medicinal Plants	80	20	100
	Hard Core Practical				
	Bot:HCP.2.5	Plant Anatomy and Embryology	40	10	50
	Bot:HCP.2.6	Cell Biology and Genetics	40	10	50
	Soft Core Practical				
	Bot:SCP.2.7.1	Microbial Technology	40	10	50
Bot:SCP.2.7.2	Plant Breeding and Propagation	40	10	50	
Open Elective Practical					
Bot:OEP.2.8	Medicinal Plants	40	10	50	

Third	Hard Core Theory				
	Bot:HCT.3.1	Plant Physiology	80	20	100
	Bot:HCT.3.2	Molecular Biology	80	20	100
	Soft Core Theory				
	Bot:SCT.3.3.1	Methods in Plant Sciences	80	20	100
	Bot:SCT.3.3.2	Genetic Engineering	80	20	100
	Open Elective Theory				
	Bot:OET.3.4	Biofertilizers and Biopesticides	80	20	100
	Hard Core Practical				
	Bot:HCP.3.5	Plant Physiology	40	10	50
	Bot:HCP.3.6	Molecular Biology	40	10	50
	Soft Core Practical				
	Bot:SCP.3.7.1	Methods in Plant Sciences	40	10	50
	Bot:SCP.3.7.2	Genetic Engineering	40	10	50
Open Elective Practical					
Bot:OEP.3.8	Biofertilizers and Biopesticides	40	10	50	
Fourth	Hard Core Theory				
	Bot:HCT.4.1	Plant Pathology and Plant Protection	80	20	100
	Bot:HCT.4.2	Plant Biotechnology	80	20	100
	Bot: HCMP. 4.3 Hard Core Major Project				
	Bot:HCMP.4.3	Project valuation	72	-	72
		Vivo-vice	48	-	48
		Internal assessment	-	30	30
		Total	120	30	150
	Soft Core Theory				
	Bot:SCT.4.4.1	Medicinal and Aromatic Plants	80	20	100
	Bot:SCT.4.4.2	Biodiversity and Conservation	80	20	100
	Hard Core Practical				
	Bot:HCP.4.5	Plant Pathology and Plant Protection	40	10	50
	Bot:HCP.4.6	Plant Biotechnology	40	10	50
Soft Core Practical					
Bot:SCT.4.7.1	Medicinal and Aromatic Plants	40	10	50	
Bot:SCT.4.7.2	Biodiversity and conservation	40	10	50	

Note: Compulsory Botanical study tour of about 7 days shall be undertaken at the end of First Semester. Candidate has to submit the tour report during HCT 1.3 Practical Examination. In case a candidate fails to undertake the study tour, his / her results will be withheld till he / she completes the Botanical study tour.

THEORY QUESTION PAPER PATTERN

Note: Answer any **five** questions. Question no. 1 is compulsory.

Max. Marks = 80

1. Answer in one or two sentences 8 X 2 = 16
- a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.

Answer any **four** of the following questions:

2. Essay type question 16
3. Essay type question 16
4. Essay type question 16
5. Essay type question 16
6. Write short notes on any **four** of the following 4 X 4 = 16
- a.
 - b.
 - c.
 - d.
 - e.

PRACTICAL QUESTION PAPER PATTERN

Max. Marks = 40

1. Experiments, Spotting, Demonstration 35 marks
2. Records and submissions 05 marks

Chairman
BOS in Botany