



Elective Theory

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Paper 4b 1 - APPLICATION OF ALGAE

Paper 4b 2 - SEED ECOPHYSIOLOGY

Paper 4b 3 - GENETICS

Paper 4b 4 - APPLICATIONS OF PLANT TISSUE CULTURE IN BIOTECHNOLOGY

Paper 4b 5 - PALYNOLOGY

Paper 4b 6 - PLANT TAXONOMY

Paper 4b 7 - PLANT STRUCTURE, DEVELOPMENT AND HISTOCHEMISTRY

Paper 4b 8 - ENVIRONMENTAL SCIENCES

Elective Theory

Paper 4b 1 - APPLICATION OF ALGAE

M.Sc. va (Candidates admitted from the academic year 2008-2009)

UNIT I

Historical perspective of use of algae for human needs. Algae as source of food and feed. Single cell protein: Chemical constituent of *Spirulina*, its vitamin and mineral content, chemical constituent of *Chlorella*. Biofertilizers: Nitrogen fixing algae; structure and function of heterocysts; reaction involved in nitrogen fixation. Significance of using bluegreen algal fertilizers.

UNIT II

Industrial uses of algae: Structure, source, extraction and uses of agar-agar, carrageenin and alginic acid. Liquid seaweed fertilizers - preparation, composition and uses.

UNIT III

Cultivation of macroalgae: Macroalgal cultivation in India. Rope cultivation, net cultivation and raft cultivation. Application of fertilizers. Control of diseases with reference to the cultivation of *Laminaria* and *Porphyra*. National laboratories involved in marine algal cultivation.

UNIT IV

Mass cultivation of microalgae: Mass culture of *Spirulina* and *Chlorella*: Composition of medium, techniques involved in their culture, harvest. Indian centers cultivating microalgae.

UNIT V

Importance of algae in fisheries; parasitic algae; algae in medicine: Algal antibiotics and other substances of pharmaceutical importance. Aquatic pollution - causes and consequences:- algae as pollution indicators; algae in sewage treatment.

UNIT VI

Algal cultures and their utility; algal culture collections of the world; tissue culture techniques with reference to Indian algae. Recombinant technology in algae. Antimicrobial activity of marine algae.

Suggested Reading

DIXON, B.S. 1973. Biology of the Rhodophyta. Oliver and Boyd. Edinburgh.

FRITSCH, F.E. 1935. Structure and Reproduction of Algae. Vol.I. Cambridge University Press. Cambridge.

FRITSCH, F.E. 1945. Structure and Reproduction of Algae. Vol.II. Cambridge University Press. Cambridge.

GRAHAM, L.E. 1993. Origin of Land Plants. John Wiley and Sons. Inc. New York.

LEMBI, CAROLE, A. and J. ROBERT WAALAND . 1988. Algae and human affairs. Cambridge University Press. Cambridge.

LOBBAN, C.S., AND M.J. WYNNE (Eds.). 1981. The Biology of Seaweeds. Blackwell Scientific Publications. Oxford.

PARKER, S.P.(Ed.). 1982. Synopsis and Classification of Living Organisms. McGraw-Hill Book Company. New York.

SOUTH, G.R., AND A. WHITTICK. 1987. Introduction to Phycology. Blackwell Scientific Publications. Oxford.

MCC, Department of Botany

Paper 4b 2 - SEED ECOPHYSIOLOGY

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective Theory

UNIT I

Dicot and Monocot Seeds. Morphology and Types. Seed Reserves. Internal and External structures:- their functional significance. Albuminous and ex-albuminous seeds. Large and small seeds. Seritinous seeds.

UNIT II

Seed Dormancy: Types of dormancy - physical, physiological, morphological, chemical and mechanical. Primary and secondary dormancy. Skoto and photo dormancy. Methods to overcome dormancy. Ecological significance of seed dormancy.

UNIT III

Seed Germination: Epigeal and hypogeal germination. Germination mechanism. Brief account of a). Germination value (Czabator) b). Germination rate (Bartellete).

UNIT IV

Total germination percent and plant percent. Germination ecology: Environmental factors and germination behaviour.

UNIT V

Seed Viability: Viability tests-their significance and importance. Orthodox and recalcitrant seeds. Critical role of seed moisture content and environmental factors on viability. Viability periods of selected Indian Forestry species.

UNIT VI

Seed Storage and Longevity: Seed germplasm and storage in different conditions. Cryopreservation. Static conservation of seeds. Clonal seed orchards. Seed certification; seed banks.

Suggested Reading

- AGRAWAL, P.K.1993. Handbook of seed testing. Division of seed science and Technology. Indian Agricultural Research Institute, New Delhi, India.
- BASKIN, C., CAROL AND JERRY M. BASKIN. 1998. Seeds: Ecology, Biogeography and Evolution of dormancy and germination. Academic Press, London.
- BEDELL, P.E. 1998. Seed Science and Technology: Indian Forestry Species. Allied Publishers Ltd., New Delhi.
- BEWLEY, I, D., AND M. BLACK. 1982. Physiology and Biochemistry of seeds in relation to germination. Springer -Verlag, New York.
- FEENER, MICHEAL. 1985. Seed Ecology. Chapman and Hall, London.
- HARTMAN, T., HUDSON AND DALE E. KESTER. 1986. Plant Propagation. Principles and Practices. Prentice Hall of India Pvt. Ltd. New Delhi, India.
- LANGE, O. L., P. S. NOBEL, C.B. OSMOND AND C. H. ZIEGLER. 1983. Physiological Plant Ecology III. *Encyclopedia of Plant Physiology* New Series Vol. 12 C. Springer – Verlag.
- SALISBURG, FRANK AND CLEON ROSS. 1986. Plant Physiology. Wadsworth Publishing Company. (Indian Edition) New Delhi.

Paper 4b 3 - GENETICS

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective Theory

UNIT I

Recombination: Syn-gene, rec-gene, recombinase, dys gene, ord gene, holiday intermediate and bridge migration.

Holiday model of recombination.

UNIT II

Sister chromatid exchange and detection of it by B and R.

UNIT III

Regulation of ara and his operons in prokaryotes.

UNIT IV

Transposable genetic elements: Ac element, transposase, transposon, DNA adenine methylase, DAM gene, simple transposon, complex transposon, Is element, selfish DNA.

Transposons in *Zea mays*. Transposable elements in prokaryotes and Mu viruses.

UNIT V

Plant cell transformation. Ti plasmid and T DNA.

UNIT VI

Induction of crown gall tumour by *Agrobacterium tumifaciens*.
Gene therapy.

Suggested Reading

- CHERAYIL, J.D. 1971. Gene and the genetic code. Tata McGraw - Hill Pub. Co.
- DE ROBERTIS AND DE ROBERTIS. 1988. Cell and Molecular Biology. 8th edition. Narosa Pub. House.
- FRIEDELDER, D. 1937. Microbial genetics. Jones and Barlett Publishers.
- FRIEDEDLER, D. 1990. Molecular Biology. Second Edition. Narosa Pub. House.
- FROSTROM, J.W. and M.T. CLEGG. 1980. Principles of genetics. Second Edition. WH Freeman and Co.
- GOODENOUGH, V and R.P. LEVINE. 1974. Genetics. Holt, Rinehart and Winston.
- LEWIN, B. 1994. Genes V. Oxford University Press.
- SOBTI R.C. and GOBE. 1991. Eukaryotic chromosomes. Narosa Publishing House.
- SMITH-KEARY, P. 1991. Molecular Genetics. Macmillan Pub. Co. Ltd. London.
- STEWART M.W. 1984. Antibodies: Their structure and function. Chapman and Hall Ltd.
- STRICKBERGER, M.W. 1990. Genetics. Third Edition. Macmillan Publishing Company.
- SUZUKI, D.T. *et al.* 1986. An introduction to genetic analysis. Third Edition. W.H. Freeman & Co.
- WATSON, J.D. *et al.* 1987. Molecular Biology of the Gene. Fourth Edition. The Benjamin Cummings Pub. Co.

Paper 4b 4 - APPLICATIONS OF PLANT TISSUE CULTURE IN BIOTECHNOLOGY
M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective theory

UNIT I

Tools, techniques and procedures of Tissue culture: Media for *in vitro* culture - minerals, vitamins, and natural adjuvants like coconut milk and fruit juice. Requirements for auxin, cytokinin and other growth regulators. Solid and liquid media. Commercial prepacked media. Design of laboratory and commercial tissue culture facility.

Procedures in Tissue Culture: Fumigation, wet and dry sterilization, ultraviolet sterilization, ultrafiltration and surface sterilization. Laminar flow hood. Maintenance of axenic cultures.

Explants for Tissue Culture: Shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs. Callus culture - initiation and maintenance of callus.

UNIT II

Principles of Micropropagation: Direct and indirect morphogenesis, somatic embryogenesis, caulogenesis, rhizogenesis, acclimatization. Synthetic seed production.

UNIT III

Tissue culture and Biotechnology: Mericloning for virus-free plants, selection of plantlets tolerant to biotic and abiotic stresses. Use of techniques of genetic engineering for obtaining transgenic plants resistant to diseases, insect pests, abiotic stress and herbicides.. Introduction of desired genes from microbes, plants and animals. Modifying the expression of resistant gene by antisense RNA technique. *In vitro* mutagenesis. Genetic engineering with protoplast and haploid cells.

UNIT IV

Applications in Agriculture, Horticulture and Forestry: Achievements and current trends in improvement of cereals, vegetable crops, oil yielding plants, ornamental plants and forest trees.

UNIT V

Tissue culture in Industrial and Medical Biotechnology: Suspension Culture systems, isolation of single and aggregate of cells. Immobilization of cells and use of bioreactors.

Protoplast Culture: Isolation of protoplast and transformation. Bioprocessing for active principles. *In vitro* production of secondary metabolites, pharmaceuticals and aromatic chemicals. Edible vaccine.

UNIT VI

Tissue Culture in germplasm Conservation: Introduction to in vitro conservation. Storage techniques, equipment, cryopreservation and tissue culture components used for storage. Achievements and current trends.

Suggested Reading

- AMMIRATO, P.V., D.A EVANS, W.R. SHARP., and Y.P.S. BAJAJ 1990. Hand Book of Plant Cell Culture. Vol 5. Ornamental Species. McGraw Hill Publishing Company. New York.
- BENCOCHEA, T., AND J.H. DODDS. 1986. Plant Protoplasts. A Biotechnological Tool for Plant Improvement. Chapman and Hall. London.
- BROWN, C.W., I. CAMPBELL AND F.G. PRIEST. 1987. Introduction to Biotechnology. Blackwell Scientific Publications. Oxford.
- BUTCHER, D.N., and D.S. INGRAM. 1982. Plant Tissue Culture. Oxford. IBH Publishing Company. Delhi.
- BUTENKO, R.G. 1985. Plant Cell Culture. MIR Publishers. Moscow.
- BULL, A.T., G. HOLT, AND M.D. LILLY. 1983. Biotechnology. International trends and Perspectives. Oxford and IBH Publishing co. New Delhi.
- DEBERG, P.C., AND R.H. ZIMMERMANN. 1981. Micropropagation-Technology and Application. Kluwer Academic Publishers. London.
- DIXON, R.A. 1985. Plant Cell Culture. A Practical Approach. IRL, Press. Oxford. London.
- DODDS, J.H., AND L.W. ROBERTS. 1985. Experiments in Plant Tissue Culture. Cambridge University Press. London.
- FRIEIFELDER, D. (Ed.) 1990. Molecular Biology. Narosa Publishing House. New Delhi.
- GEORGE E.F., AND P.D.SHERINGTON. 1984. Plant Propagation by Tissue Culture. Exegetics Ltd. England.
- KHUSH, G.S., AND G.H. TOENNIENSSSEN. 1991. Rice Biotechnology. The Alden Press Ltd. Oxford.
- LEWIN, B. 1994. Genes V. Oxford University Press. Oxford
- LINDSEY, K. 1992. Plant Tissue Culture Manual. Kluwer Academic Publishers.

- MARX, F.L. 1989. A Revolution in Biotechnology. Cambridge University Press. Cambridge. New York.
- MOORE, R., AND W.D. CLARK. 1995. Botany: Plant Form and Function. Vol. I. W.M.C. Brown Publishers.
- MURRAY MOO-YOUNG, (Ed.). 1992. Plant Biotechnology. Pergamon Press.
- NARAYANASWAMY, S. 1994. Plant Cell and Tissue Culture. Tata Mc Graw - Hill Publishing Company Limited. New Delhi.
- PRAVE, P., *et al.* 1987. Fundamentals of Biotechnology. FDR.
- PUROHIT, S.S., AND S.K. MATHUR. 1993. Fundamentals of Biotechnology. Agrobotanical Publishers. India.
- RAGHAVAN, V. 1977. Experimental Embryogenesis in Vascular Plants. Academic Press. London.
- RAGHAVAN, V., AND M.S. SWAMINATHAN. 1986. Embryogenesis in Angiosperms. A Developmental and Experimental Study. Cambridge University Press. Cambridge.
- REINERT, J., AND Y.P.S. BAJAJ. 1977. Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Springer-Verlag. Berlin.
- REINERT, J., AND YEOMAN. 1988. Plant Cell and Tissue Culture - A Laboratory manual.
- REINHARD, B.E., AND M.H. ZENK. 1977. Plant Tissue Culture and its Biotechnological Application.
- SEN, S.K., AND LGIKS. 1983. Plant Cell Culture in Crop Improvement. Plenum Press. New York.
- STREET, H. E. 1977. Plant Tissue and Cell Culture. Blackwell Scientific Pub. Oxford.
- THOMAS, E., AND M.R.D. WYKAHAM. 1975. From Single Cell to Plants. Wykeham Publications Ltd. London.
- TORRES, C.K. 1989. Tissue Culture Techniques for Horticultural Crops. Van Nostrand Reinhold. New York.
- TREHAN, K. 1990. Biotechnology. Wiley Eastern Limited. New Delhi.
- TREVAN, M.D., S. BOFFEY, K.J. GOULDING, AND P. STANBURG. 1977. Biotechnology: The Biological Principles. Tata McGraw Hill Publishing Company Limited. New Delhi.
- YEOMAN. 1987. Plant Cell Culture Technology. Narosa Publishing House. New Delhi

Paper 4b 5 - PALYNOLOGY

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective Theory

UNIT I

History of palynology. Palynology in India. Contribution of the following in the field of palynology - Wodehouse, R. P., Erdtmen, G., Iverson, J., Nair, P.K.K.

Terminologies used in spore and pollen description according to LLP 1994.

Difference between pollen and spores.

UNIT II

Sporoderm: Exine - Chemical composition, structure and function. Evolutionary trends.

Intine - Ex intine, End intine - structure and function. Oncus.

Exineless Pollen.

Harmomegathy.

Aperture: Inaperturate grain, simple and compound aperture form and function. NPC classification, Pseudoaperture, aperture membrane.

Ornamentation: Sculpture: LO Analysis, various types of ornamentation.

Significance of ornamentation in pollination ecology.

UNIT III

Pollen development in angiosperms.

Shape and size of pollen. Chemical constituents of pollen.

Pollination ecology with reference to pollen. Threads - Sporopollenin and Nonsporopollenin threads. Pollenkitt - origin, chemical composition and function.

Polyads types. Anemophilous, entomophilous pollen, saccate pollen, orbicules.

UNIT IV

Pollen Physiology: Pollen collection, Storage - Cryopreservation. Pollen viability, factors that affect pollen viability, Viability Test :- Germination assay, in vitro, in vivo, Non Germination - FCR Test.

Pollen culture.

Technique: Acetolysis method of pollen preparation. Sample preparation for TEM and SEM.

UNIT V

Palynotaxonomy - Use of pollen in classification of plants.

Mellittopalynology: Pollen in honey.

Geo/paleopalynology: Pollen production, transport, preservation, sample collection, pollen diagram, construction and interpretation of data. eg. Pulicat Lake (Chennai).

UNIT VI

Aeropalynology - collection, identification, pollen calendar. Pollen allergy - Testing patients and treatment of patients.

Forensic Palynology: Pollen used as an aid to identify crime.

Iatropalynology: Pollen in pharmaceuticals.

Copropalynology: Pollen in dung.

Suggested Reading

AGASHE, S.N. 1994. Recent trends in Aerobiology, Allergy, Immunology. Oxford, IBH Publishing Co. Pvt. Ltd., New Delhi.

DOROTHY HODGES. 1974. The Pollen loads of honey bees. Bee Research Association. London.

DRIESSEN, M.N.B.M. 1991. Pollen and Pollinosis. Medical and Botanical aspects.

EVA CRANE. 1970. Honey - A Comparative Survey. John Wiley and Sons, Heinemann, London.

FAEGRI, K AND J. IVERSON. 1989. Text book of Pollen analysis. John Wiley and Sons, New York.

HESLOP-HARRISON. J. 1973. Pollen Development and Physiology. London Butterworth.

KEDVES, M. 1986. Introduction to the palynology of Pre-Quaternary Deposits. Part I & II. Pub. House of the Hungarian Academy of Sciences, Budapest.

MISHRA, R.C. 1995. Honey Bees and their management in India ICAR. New Delhi.

MOORE, P.D AND J. A. WEBB. 1978. An Illustrated guide to pollen analysis. Hodder and Stoughton, London.

NAIR, P.K.K, A.P. JOSHI AND S.V. GANGAL. 1986. Air borne Pollen spores and other plant materials of India - A survey. CSIR for Biochemical and National Botanical Research Institute, Lucknow.

OGDEN, C.E., S.G. RAYNOV, V.J. HAYES, M. D. LEWIS AND J.H. HAINES. 1974. Manual for sampling airborne pollen. Hafner Press, London.

- SHIVANNA, K.R and N.S. RANGASWAMY. 1992. Pollen Biology, A laboratory manual. Narosa Pub. House, New Delhi.
- SINGH. S. 1962. Bee keeping in India. ICAR, New Delhi.
- THANIKAIMONI. G, C. CARATINI, B.S. VENKATACHALA, C.G.K. RAMANUJAM AND R.K. KAV. 1984. Selected angiosperm pollen from India and French Institute, Pondicherry.
- TILAK, S.T. 1982. Aerobiology. Vijayanti Prakashan, Aurangabad.
- TILAK, S.T. 1987. Air monitoring (Practical Manual). Vijayanti Prakashan, Aurangabad.
- TILAK, S.T. 1989. Air borne pollen and fungal spores. Vijayanti Prakashan. Aurangabad.
- TIWARI, R.S. (ed.) 1995. Coaliferous fuel resource of India. Parameters of Studies in Palynology and Biopetrology.
- TRAVERSE, A. 1988. Palaeopalynology. Unwin Hyman, London.
- TSCHUDY, R.H, Scott, A.R. 1969. Aspects of Palynology. Wiley Interscience, New York.
- WODEHOUSE, R.P. 1935. Pollen grain - their structure, identification and significance in Science and Medicine. Hafner Publishing Co. New York.

Paper 4b 6 - PLANT TAXONOMY

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective Theory

UNIT I

Classification systems prior to Darwin: Systems based on habit, sexual systems, systems based on form relationships.

Post-Darwinian systems: Systems based on Ranalien school, systems based on Englearean school.

UNIT II

Phytography - methods and styles of writing descriptions. Botanical illustrations, their importance and important illustrated floras. Plant photography and pictorial floras.

UNIT III

Characters: analytic and synthetic; qualitative and quantitative; primitive and advanced, homologous and analogous.

UNIT IV

Taxonomic literature: Print and online sources.

UNIT V

Floristic regions of the world and distribution patterns of Plants. Vegetation types of India. Methods of vegetation analysis.

UNIT VI

Major milestones in Floristic studies in India with special reference to Tamil Nadu.

Suggested Reading

AHMEDULLAH, M., AND M.P. NAYAR. 1987. Endemic Plants of the Indian Region. Vol. I. Botanical Survey of India. Howrah.

CRONQUIST, A. 1968. The Evolution and Classification of Flowering Plants. Houghton Mifflin. Boston.

DAVIS, P.H., AND V.H. HEYWOOD. 1965. Principles of Angiosperm Taxonomy. Oliver & Boyd. Edinburgh.

DOBSON, A.P. 1996. Conservation and Biodiversity. Scientific American Library. New York, U.S.A.

GAMBLE, J.S., AND C.E.C. FISCHER. 1967. Flora of the Presidency of Madras. Vols. I - III. Botanical Survey of India. Calcutta.

- GRAHAM, L.E. 1993. Origin of Land Plants. John Wiley & Sons. Inc. New York.
- GREUTER, W, (Ed.). 2000. International Code of Botanical Nomenclature. (St. Louis Code). Koeltz Vesentific Books. Germany.
- GROOMBRIDGE, B, (Ed.). 1992. Global Biodiversity: Status of The Earth's Living Resources. Chapman and Hall. London.
- HENRY ,A.N., M.CHANDRABOSE. 1980. An Aid to International Code of Botanical Nomenclature. Today & Tomorrow's Printers and Publishers. New Delhi.
- HESLOP-HARRISON, J. 1953. New Concepts in Flowering Plant Taxonomy. Heinemann Ltd. London.
- HEYWOOD, V.H. 1967. Plant Taxonomy. Edward Arnold Ltd. Great Britain.
- HEYWOOD, V.H. 1995. Global Biodiversity Assessment. Cambridge University Press, Cambridge, U.K.
- HUTCHINSON, J. 1973. The Families of Flowering Plants. 3rd Edition. Oxford University Press. Oxford.
- JAIN, S.K. and R.R. RAO. 1977. A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.
- JOHRI, B.M. 1994. Botany in India: History and Progress. Vol-I. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- JONES, S.B., AND A.E. LUCHSINGER. 1987. Plant Systematics. 2nd Edition. McGraw-Hill Book Company. New York.
- JUDD, W. S, C. S. CAMPBELL, E. A, KELLOG, P. F. STEVENS AND N. J. DONOGHUE. 2002. Plant Systematics – A phylogenetic approach. Sinauer Associates, Inc, Massachusetts, USA
- LAWRENCE, G.H.M. 1951. Taxonomy of Vascular Plants. The Macmillan Company. New York.
- MABBERLEY, D.J. 2005. *The Plant-Book, A portable dictionary of the vascular plants.* Cambridge University Press, United Kingdom
- MOORE, R., W.D. CLARK, K.R. STERN AND D. VODOPICH. 1995. Botany : Plant Diversity. Wm. C. Brown Publishers. London.
- NAIK, V. N. 2000. Taxonomy of Angiosperms. Tata McGraw – Hill Publishing Company Limited , New Delhi.

- NAYAR, M.P., AND R.K. SASTRY. 1987-1990. Red Data Book on Indian Plants. Vols. I - III. Botanical Survey of India. Howrah.
- NAYAR, M.P., 1996. "Hot Spots" of Endemic plants of India, Nepal and Bhutan. Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India.
- QUICKE, D.L.J. 1993. Principles and Techniques of Contemporary Taxonomy. Chapman and Hall. London.
- RADFORD, A.E., W.C. DICKISON, J.R. MASSEY, AND C.R. BELL. 1974. Vascular Plant Systematics. Harper & Row. New York.
- RAVEN, P.H., R.F. EVERT, AND S.E. EICHHON. 1992. Biology of Plants. 5th Edition. Worth Publishers. New York.
- SANTAPAU, H. AND H.A. HENRY. 1994. A dictionary of the flowering plants in India, CSRI, New Delhi.
- SINGH, G. 2005. Plant Systematics – Theory and Practice. Oxford & IBH, New Delhi.
- SOLTIS, D. E., P. S. SOLTIS, P. K. ENDRESS AND M. W. CHASE. 2005. Phylogeny and Evolution of Angiosperms. Sinauer Associates, Inc, Massachusetts, USA.
- SIMPSON, M. G. 2006. Plant Systematics. Elsevier Academic Press, California, USA.
- SIVARAJAN, V.V. 1989. Introduction to Principles of Plant Taxonomy. Oxford and IBH Publishing Co. New Delhi.
- STACE, C.A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London.
- STUESSY, T. F. 2002. Plant Taxonomy. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
- SUBRAMANIAM, N.S. 1995. Modern Plant Taxonomy. Vikas Publishing House. New Delhi.
- TAKHTAJAN, A. 1997. Diversity and Classification of Flowering Plants. Bishen Singh and Mahendra pal Singh, Dehra Dun, India.

Paper 4b 7 - PLANT STRUCTURE, DEVELOPMENT AND HISTOCHEMISTRY

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective Theory

UNIT I

Introduction to the use of histochemical techniques in understanding vegetative and reproductive structure and development of plants.

UNIT II

Microtechnique: Free-hand section; Clearing and whole mounts; wax-embedded sections and staining procedures; plastic-embedded thin sections.

UNIT III

Microscopy: Selected light microscopic procedures - Normaski DIC; polarized light microscopy; fluorescence microscopy; dark-field and phase contrast microscopy.

UNIT IV

Histochemical Techniques: Scope and principles of Histochemistry. Classification and chemistry of Biological stains. Bright-field dyes and flurochromes

UNIT V

Staining procedures, histochemical localization of carbohydrates, proteins, lipids, nucleic acids, minerals and secondary metabolites.

UNIT VI

Principle and application of enzyme histochemistry and immuno histochemistry.

Suggested Reading

Clark, G. 1981. Staining procedures. Williams and Wilkins, Baltimore.

Conn, H. J. 1977. Biological stains. R. D. Lillie (ed.). The Williams and Wilkins Co. Reprinted by Sigma Chemical Company. 1991. St. Louis.

Esau, K. 1972. Plant Anatomy. John Wiley and Sons, New York.

Jensen, W. A. 1962. Botanical Histochemistry. Principles and practices. W. H. Freeman and Company, San Francisco.

Krishnamurthy, K. V. 1988. Methods in Plant Histochemistry. S. Viswanathan Printers and Publishers private limited, Madras.

O' Brien, T. P., and M. E. Mc Cully. 1969. Plant structure and development. A Pictorial and physiological approach. The Mac millan Company, London.

Paper 4b 8 - ENVIRONMENTAL SCIENCES

M.Sc. va (Candidates admitted from the academic year 2008-2009)

Elective Theory

UNIT I

Ecosystem Concepts: Introduction - Structure & function of an ecosystem. Ecological energetics. Energy flow in eco-system. Nutrient cycles in ecosystem. Atmospheric cycles. Edaphic nutrient cycles. Kinds of ecosystem.

UNIT II

Water Pollution: Sources of pollution and pollutants. Ground water pollution. Marine pollution. Prevention and control of water pollution. Water quality management in India.

Water quality index.

UNIT III

Soil Pollution: Sources and pollutants. Effect on plants. Biomagnification; Prevention and control of soil pollution. Role of biofertilizers in reducing the soil pollution.

UNIT IV

Air Pollution: Sources of pollutants. Carbon and sulphur compounds, Nitrogen oxides, Acid rains, Ozone fluorides, Hydrocarbons, Particulate matters. Prevention and control of air pollution.

UNIT V

Environmental education and information-goals, objectives and principles. Remote sensing and ecosystem management. Biomass based energy-biogas, petroplants. Non conventional energy resources.

UNIT VI

Bioremediation: Definition. Need and scope of bioremediation. Environmental application of bioremediation. Future outlook. Phytoremediation. Biotechnology of cleaning up the environment by plants.

Suggested Reading

ODUM, E.P. 1971. Fundamentals of ecology. W. B. Sanders, New York.

DASH, M.C. 1993. Fundamentals of ecology. Tata Mc Graw Hall Publications. New Delhi.

FASTER, C.F. AND D. A. JOHNWARE. 1987. Environmental Biotechnology. Ellis Horwood Ltd.

SHARMA, P.D. 1992. Ecology and Environment. Rastogi publications, Meerut.

RANA, S.V.S 2003. Essentials of Ecology and Environmental Science. Prentice Hall of India, New Delhi.