

SHIVAJI UNIVERSITY, KOLHAPUR
DEPARTMENT OF BOTANY

Syllabus for the Semester System Examination (Choice Based Credit System) w.e.f. June 2013 for M.Sc. Part-I (Semester I & II) **R. No.dated** and for M. Sc. Part-II (Semester III & IV) **R. No..... dated.....** from June 2014.

M. Sc. BOTANY REVISED SYLLABUS (Choice Based Credit System)

1. The entire course of M. Sc. (Botany) will be of **four Semesters** spread over two years.
2. There shall be **four theory courses** and **four practical courses** in every semester.
3. Each theory course shall have four units and each practical course shall have two units (based on the theory).
4. Each unit in theory course shall comprise 15 lectures each of 60 minutes duration and there shall be four lectures per theory course per week. There shall be one practical (not less than three hours duration) for each theory course per week. Library/Reference-work/Excursion/Field-work/Seminar/Group Discussion/Project work shall also be organized in every week.
5. Department of Botany shall offer **two elective papers** each of 100 marks for the students of other PG departments of the University. Elective paper shall consist of four units having 60 lectures and will be available to PG Part-II students during Semester III and Semester IV. **The decision regarding the admission to such other departmental students will be made by the Departmental Committee.**
6. There shall be at least a short (up to 3 days) and a long tour (not exceeding 15 days) per year for all M. Sc. Part-I and Part-II students. The long tour may be arranged to a region out of the state covering various Botanical Regions/Research Institutes/Centres etc. Tours are the part of curriculum and are obligatory to each student, failing which they will not be considered eligible to appear for the examination. Under unavoidable circumstances, if the student fails to attend the tour, he/she will be required to produce a justifiable evidence for not attending the tour. However, in lieu of tour the candidate will have to complete the work assigned by the Department.
7. Following documents/materials shall have to be produced by each student at the time of practical examination (at the end of each Semester)

- i) Submission of a laboratory journal of practical records.
- ii) Submission of a set of *micro preparations (semipermanent/permanent) of plant materials illustrating the subject matter of the relevant paper.
- iii) Submission of a *field record book (**in his/her own handwriting**) duly signed by the concerned teacher and at least 15 herbarium specimens (weeds and cultivated plants)/preserved specimens collected by the candidate during the field work or excursion tour. Rare, endangered and threatened (RET) plant species should not be collected and used for submission.

8. The Department offers following specializations[#] at M. Sc. II (Semester III and IV).

- Plant Physiology
- Mycology and Plant Pathology
- Cytogenetics and Plant Breeding
- Energy, Ecology and Environment
- Angiosperm Taxonomy
- Marine Botany
- Plant Biotechnology
- Plant Protection**
- Plant Diversity**
- Palaeobotany (Presently Suspended)

based on the merit, willingness and availability of seats.

* wherever applicable.

**offered by the Department of Botany, Yashwantrao Chavan Institute of Science, Satara

9. Entire course of M. Sc. Botany will be of **2400** marks. Every Semester will be of 600 marks [400 marks for theory (four courses) and 200 marks for practical (four courses)].

10. Examination of each **theory course** shall be of **100 marks** [80 (university examination) + 20 (internal examination)]. University examination of 80 marks (03 hours duration) will be conducted at the end of each Semester. Internal examination of 20 marks (comprising 20 multiple choice questions) will be conducted before the semester examination during each semester.

11. Each practical course examination will be based on the respective theory course and will be of **50 marks** [40 (University examination) + 10 (internal assessment)] Duration of university practical examination shall be of five hours.
12. The question paper of theory course (80 marks) will consist of seven questions, carrying 16 marks each, of which the student shall have to attempt **five** questions. The last question will be **compulsory** consisting of short answer type questions. The types of questions and their distribution will be as follows:
- i) Descriptive or essay type questions (50 – 60 %)
 - ii) Short answer type questions (20 – 30 %)

M. Sc. Part II (Semester III)

Theory papers

B O 3.1: Cytogenetics and Crop Improvement

B O 3.2: Biotechnology and Genetic Engineering

Elective I (B O 3.5)

: Plant Sciences, Human Progress and Prosperity

Special paper I

B O 3.3.1: Plant Physiology

B O 3.3.2: Mycology and Plant Pathology

B O 3.3.3: Cytogenetics and Plant Breeding

B O 3.3.4: Energy, Ecology and Environment

B O 3.3.5: Angiosperm Taxonomy

B O 3.3.6: Marine Botany

B O 3.3.7: Plant Biotechnology

B O 3.3.8: Plant Protection

B O 3.3.9: Plant Diversity

B O 3.4.10: Palaeobotany (Presently suspended)

Special paper II

B O 3.4.1: Plant Physiology

B O 3.4.2: Mycology and Plant Pathology

B O 3.4.3: Cytogenetics and Plant Breeding

B O 3.4.4: Energy, Ecology and Environment

- B O 3.4.5: Angiosperm Taxonomy
- B O 3.4.6: Marine Botany
- B O 3.4.7: Plant Biotechnology
- B O 3.4.8: Plant Protection
- B O 3.4.9: Plant Diversity
- B O 3.4.10: Palaeobotany (Presently suspended)

Practical Papers

- B O P 3.1: Cytogenetics and Crop Improvement
- B O P 3.2: Biotechnology and Genetic Engineering
- B O P Special paper I
- B O P Special paper II

M.Sc. Part II (Semester IV)

Theory Papers:

- B O 4.1: Plant Physiology and Metabolism
- B O 4.2: Biodiversity, conservation and utilization

Elective II (B O 4.5)

: Plants: A Biological Capital

Special paper III

- B O 4.3.1: Plant Physiology
- B O 4.3.2: Mycology and Plant Pathology
- B O 4.3.3: Cytogenetics and Plant Breeding
- B O 4.3.4: Energy, Ecology and Environment
- B O 4.3.5: Angiosperm Taxonomy
- B O 4.3.6: Marine Botany
- B O 4.3.7: Plant Biotechnology
- B O 4.3.8: Plant Protection
- B O 4.3.9: Plant Diversity
- B O 4.3.10: Palaeobotany (Presently suspended)

Special Paper IV

B O 4.4.1: Plant Physiology

B O 4.4.2: Mycology and Plant Pathology

B O 4.4.3: Cytogenetics and Plant Breeding

B O 4.4.4: Energy, Ecology and Environment

B O 4.4.5: Angiosperm Taxonomy

B O 4.4.6: Marine Botany

B O 4.4.7: Plant Biotechnology

B O 4.4.8: Plant Protection

B O 4.4.9: Plant Diversity

B O 4.4. 10: Palaeobotany (Presently suspended)

.....

M.Sc. PART -II (SEMESTER III)

PAPER-IX (B O 3.1): CYTOGENETICS AND CROP IMPROVEMENT

Total Lectures: 60

UNIT I:

Cytology: Chromatin organization, Chromosome structure and packaging of DNA, Molecular organization of centromere and telomere, Nucleolus and ribosomal RNA genes, Euchromatin and heterochromatin, Karyotype analysis and evolution, Banding patterns [15]

UNIT II:

Genetics of Prokaryotes and Eukaryotes: Mapping of prokaryotic and eukaryotic genome, Mobile genetic elements and their significance, Gene families [7]

Crop Genetic Resources: Centres of origin of cultivated plants, Importance of genetic conservation, Global network for genetic conservation and utilization in major crops of world, Institutes engaged in conservation and improvement of crop genetic resources, Wild relatives of crop plants, Gene banks, Gene sanctuaries [8]

UNIT III:

Population and Evolutionary Genetics: Evolutionary theory and population genetics, Theory of allele frequencies, Changes in genetic structure of population: Natural selection, Migration, Mutation, Genetic drift. Genetic variation in natural populations: Protein variation and variation with RFLP and DNA sequences [15]

UNIT IV:

Classical and modern methods of crop breeding and improvement: Genetic variability in crop plants, Heterosis, Methods of breeding in self and cross pollinated crops, Use of cytoplasmic male sterility in hybrid breeding, Marker assisted breeding [15]

CYTOGENETICS AND CROP IMPROVEMENT PAPER IX: PRACTICAL COURSE

UNIT V:

1. Determination of mitotic index
- 2-3. Karyotype analysis of *Allium cepa*
4. Isolation of plasmid from *E. coli*
5. Orcein banding
6. Field visit: National Research Institutes/NBPGR centre/Seed company

UNIT VI:

1. Meiotic studies in *Allium cepa*
 - 2-3. Study of floral biology of crop plants
 4. Genetic problems on gene mapping in higher plants
 5. Centres of origin of crop plants
 6. Determination of allele frequency in population
-

Reference Books:

- Bahekar V. S.** 1993. Problems in Genetics Vol. I Arati Prakashan , Aurangabad.
- Chahal G. S. and Gosal S. S.** 2003, Principles and Procedures of Plant Breeding biotechnological and conventional approaches. Narosa Publishers, New Delhi.
- Darnel, J., Lodish, H. and Baltimore, D.** 1990 Molecular cell biology. Scientific American Books.
- Gardner, E. J.** 1991 Principles of Genetics. John Wiley and sons, New York.
- Jahier, J.** 1996 Techniques of plant Cytogenetics. Oxford and IBH Publishing.
- Lewin, B.** 2008, Genes IX. Oxford University Press,
- Mandal, A. K., Ganguli, P. K. and Banarjee, S. P.** 1991 Advances in plant breeding Vol. I and II. CBS Publishers & Distributors.
- Mayo, O.** 1980. The theory of Plant Breeding. Clarendon Press, Oxford.
- Mitra Sandhya** 1994 Genetics a blueprint of life. Tata McGraw- Hill Publishing Company Ltd, New Delhi.
- Roy Darbeshwar** 2000, Plant breeding analysis and exploitation of variance. Narosa Publishers, New Delhi.
- Russell P. J.** 1998. Genetics (Fifth edition) Benjamin / Cummings Publishing Company Canada.
- Sharma J. R.** 1998 Statistical and Biometrical techniques in Plant Breeding New Age International Publishers, New Delhi.
- Sharma, A. K. and Sharma, A.** 1980. Chromosome techniques- Theory and practice. Butterworth and Co. (Publishers) Ltd., London.
- Sharma, J. R.** 1994 Principles and practice of plant breeding. Tata McGraw Hill Publ. Co. Ltd., New Delhi.
- Singh, B. D.** 2000. Plant breeding- Principles and methods. Kalyani Publishers, Ludhiana.
- Snustad D. P. and Simmons M. J.** 2003, Principles of Genetics, (Third edition) John Wiley and Sons Inc.

Strickberger, M. W. 1968. Genetics. The Macmillan Company, New York.

Swaminathan, M. S., Gupta, P. K. and Sinha, U. 1983. Cytogenetics of crop plants. Macmillan India Ltd., Delhi.

Swanson, C. P. 1968. Cytology and Cytogenetics. Macmillan and Co. Ltd., London.

Sybenga, J. 1975. Meiotic configurations. Springer Verlag, Berlin, Germany.

Winkler, U. Ruger W. and Wackernagel W. 1979. Bacterial, phage and molecular genetics. Narosa Publication, New Delhi.

Journals:

Indian Journal of Genetics and Plant Breeding. Journal of Genetics. Journal of Cytology and Genetics. Cytologia. Caryologia. International Journal of Food Science and Technology. Plant Breeding. Theoretical and Applied Genetics.

M. Sc. PART- II (SEMESTER III)

PAPER-X (B O 3.2): BIOTECHNOLOGY AND GENETIC ENGINEERING

Total Lectures: 60

UNIT I:

Concept, Scope and importance of Biotechnology	[2]
Plant cell and tissue culture: Laboratory requirements, tools and techniques for plant tissue culture, culture media and their constituents, types of cultures, applications of plant tissue culture	[6]
Somaclonal variation and its significance	[4]
Protoplast culture and somatic hybridization	[3]

UNIT II:

Microbial nutrition and culture, Isolation of micro-organisms, Production of organic compounds by microbial fermentation, Production of enzymes by micro-organisms, Production of antibiotics by micro-organisms	[7]
Microbial transformations, Single cell proteins	[4]
Bio pesticides and Bio fertilizers: concept, production and importance	[4]

UNIT III:

Concept, principles, applications and consequences of recombinant DNA technology	[2]
Enzymes used in recombinant DNA technology, Cloning vectors, Construction of chimeric DNA	[8]
Genetic transformation of eukaryotes	[2]
Molecular probes, Isolation of genes	[3]

UNIT IV:

Genomics: <i>Arabidopsis</i> genome, Comparative genomics, Functional genomics	[5]
Proteomics: Rationale, basic assumptions, methods for protein engineering	[5]
Intellectual property rights (IPR) and protection (IPP): Concept, importance, ecological risks and ethical concerns	[5]

BIOTECHNOLOGY AND GENETIC ENGINEERING PAPER X: PRACTICAL COURSE

UNIT V:

1. Preparation of MS medium for Plant tissue culture
- 2-3. Callus culture
4. Micro propagation
5. Isolation and culture of soil/ root nodule bacteria
6. Production of alcohol by microbes and its estimation

UNIT VI:

1. Isolation of genomic DNA
 2. Agarose gel electrophoresis
 - 3-4. *Agrobacterium* mediated transformation
 5. Amino acid sequence and blasting
 6. Nucleotide sequence and blasting
-

Reference Books:

- Gupta, P. K.** 2010. Plant Biotechnology. Rastogi Publications, Meerut.
- Glick, B. R. and Pasternak, J. J.** 1994. Molecular Biotechnology- Principles and Applications of Recombinant DNA. ASM Press, Washington D. C.
- Gupta, P. K.** 2009. Biotechnology and Genomics. Rastogi Publications, Meerut.
- Trehan, K.** 1994. Biotechnology. Wiley Eastern Limited, New Delhi.
- Ramawat, K. G.** 2006. Plant Biotechnology. S. Chand and Company Ltd., New Delhi.
- Trivedi, P. C.** (ed.) 2000. Plant Biotechnology- Recent Advances. Panima Publishing Corporation, New Delhi.
- Chawla, H. S.** 1998. Biotechnology in Crop Improvement. International Book Distributing Company, Lucknow.
- Aneja, K. P.** 1996. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation. Weshwa Prakashan, New Delhi.
- Sullia, S. B. and Shantharam, S.** 2005. General Microbiology. Oxford & IBH Publ. Ltd., New Delhi.
- Tauro, P.; Kapoor, K. K. and Yadav, K. S.** 1996. An Introduction to Microbiology. Wiley Eastern Limited, New Delhi.
- Razdan, M. K.** 1994: An Introduction to plant tissue culture. Oxford & IBH Publ. Ltd., New Delhi.
- Kumar, H. D.** 1993. Molecular Biology and Biotechnology, Vikas Publ., New Delhi.
- Gamborg, O. L., Phillips, G. C.** 1995. Plant Cell, Tissue and Organ Culture- Fundamental Methods. Narosa Publ. House, New Delhi.
- Reinhert, J. and Bajaj ,Y. P. S.** 1977. Applied and fundamental aspects of plant cell, tissue and organ culture, Springer Verlag, Berlin.
- Dodds, J. H. and Roberts ,L. W.** 1985. Experiments in plant tissue culture. Cambridge University Press, Cambridge.
- Boyce, C.O.L.** 1986. Novo's Handbook of Practical Biotechnology. Novo Industry.
-

M. Sc. PART- II (SEMESTER III)
PAPER-XI (B O 3.3.1): PLANT PHYSIOLOGY
(SPECIAL PAPER I) ADVANCED PLANT PHYSIOLOGY AND PLANT
BIOCHEMISTRY

Total Lectures: 60

UNIT I:

Respiration: Glycolysis in plants and its regulation, Regulation of Pentose Phosphate Pathway and TCA Cycle, Regulation of electron transport chain and role of alternate oxidase. [15]

UNIT II:

Photosynthesis: A brief outline of chlorophyll biosynthesis and the pigment organization in thylakoid membrane. Regulation of PCR Cycle and C4 Pathway; RUBISCO and PEPCase; C3 - C4 intermediates. [15]

UNIT III:

Carbohydrate metabolism: Regulation of starch and sucrose biosynthesis, Synthesis and degradation of cellulose, A brief idea of pectin biosynthesis and enzymes involved in pectin degradation. [10]

Organic acid metabolism: Metabolism and roles of oxalic acid, ascorbic acid and malic acid [5]

UNIT IV:

Secondary metabolites : Shikimate Pathway and its role in biosynthesis of Secondary Metabolites. [8]

Phosphorus nutrition – Forms of phosphorus in soil. Phosphorus uptake, factors controlling ‘P’ uptake, ‘P’ fractions in plants. Role of Pyrophosphate in plant metabolism. [7]

PLANT PHYSIOLOGY PAPER XI: PRACTICAL COURSE I

UNIT V:

1. To study the effect of potassium on glycolytic enzyme pyruvate kinase .
2. Estimation of starch.
3. Study of Oxalic acid accumulation in leaf tissue.
4. Estimation of Ascorbic acid.
5. Estimation of Polyphenols.
6. Estimation of Cellulose.

UNIT VI:

1. Study of Phosphorus distribution in different plant parts.
2. Study of enzyme inorganic pyrophosphatase.
- 3-4. Study of effect of light on chlorophyll biosynthesis.
5. Study of enzyme polygalacturonase.
6. Study of enzyme phenylalanine ammonia lyase.

Reference Books:

- Bidwell, R. C. S.** (1979): Plant Physiology. Macmillan
- Bonner, J. and Varner, J.E.** (1972): Plant Biochemistry. IBH.
- Edwards G. and Walker D.,** eds. (1983). C3, C4: mechanisms, and cellular and environmental regulation, of photosynthesis. Oxford: Blackwell Scientific Publications.
- Govindjee, H.** (ed.) (1982): Photosynthesis, Vol. 1 and Vol. 2. Academic Press, N.Y. (Vol. 1); 0-12- 294302-2 (Vol. 2))
- Hopkins, W. C.** (1995): Introduction to Plant Physiology. Wiley, New York.
- Krishnamurthy, H.N.** (1992): Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.
- Marschner, H. W.** (1986): Mineral nutrition of Higher Plants. First Edition, Academic Press, Elsevier Science Ltd.
- Marschner, H. W.** (2003): Mineral nutrition of Higher Plants. Second Edition, Academic Press, Elsevier Science Ltd.
- Moore, T.C.** (1974): Research experience in Plant Physiology, A Laboratory manual. Springer-Verlag, Berlin.
- Mukherjee, S.P. and Ghosh A.N.** (1996): Plant Physiology. New Central Book Agency (P) Limited Tata McGraw Hill.
- Noggle, G.R. and Fritz, G. J.** (1976): Introductory Plant Physiology. Prentice- Hall, Inc., Englewood Cliffs, NJ.
- Pessaragli, M.** (Ed.). (2001). Handbook of Plant and Crop Physiology, 2nd Edition, Revised and Expanded. Marcel Dekker, Inc., New York
- Pessaragli, M.** (Ed.). (2005). Handbook of Photosynthesis, 2nd Edition, CRC Press, Taylor & Francis Publishing Company, Florida
- Randhir Singh and Sawhney S. K.** (1988): Advances in frontier Areas of Plant Biochemistry. Prentice Hall of India
- Sadasivam S. and Manickam A.** (1996): Biochemical methods. New Age International.
- Salisbury, F. B. and Ross, C.W.**(1992): Plant Physiology IV ed. Cengage Learning
- Smith, H.** (1975): Phytochrome and Photomorphogenesis. McGraw-Hill Inc.,US
- Taiz, L. and Zeiger, F.** (1998): The Plant Physiology. Second Edition, Sunderland: Sinauer Associates.
- Wilkins, M. B.** (1976): Physiology of Plant Growth and Development. McGraw-Hill Publishing Company Limited

Journals

Annual Review of Plant Physiology and Molecular Biology

Annual Review of Plant Physiology
Indian Journal of Plant Physiology
Journal of Experimental Botany
Physiologia Plantarum, Sweden
Plant Physiology, Bethesda, USA
Plant Cell

M. Sc. PART- II (SEMESTER III)
PAPER-XI (B O 3.3.2): MYCOLOGY & PLANT PATHOLOGY
(SPECIAL PAPER I) TAXONOMY OF FUNGI

Total Lectures: 60

UNIT I:

General features of fungi [4]

Various systems of classification of fungi: Ainsworth (1973), Webster (1980) and Hawksworth *et al.* (1995) [4]

Micrometry: Study of micrometry and its significance in fungal taxonomy. [4]

Culture: Types of culture media and their preparation, special culture media. [3]

UNIT II:

Criteria used in the classification of fungi

Morphology: External and Internal, Vegetative and Reproductive, Cytological and Genetical. [15]

UNIT III:

Criteria used in the classification of fungi

Serological and Nutritional. [5]

Physiological and Biochemical. [5]

Host specificity. [2]

Ultrastructural and cultural. [3]

UNIT IV:

Microtomy: Types of microtomes, Techniques of microtomy, stains and fixatives used. [11]

Status of fungi and research in Mycology and Plant Pathology in India: An overview. [4]

MYCOLOGY PAPER XI: PRACTICAL COURSE I

UNIT V:

1. Measurement of fungal dimensions and identification of fungal genera.
- 2- 4. Measurement of spore size and study of spore morphotypes, determination of standard deviation and frequency distribution, histogram and polygon.
- 5-6. Preparation of culture media, PDA, Czapek Dox Agar and Richard's medium.

UNIT VI:

- 1-2. Microtomy of fungal specimens.
3. Isolation of fungi from soil and their identification and classification
4. Isolation of fungi from water and their identification and classification.
5. Isolation of fungi from air and their identification and classification.
6. Isolation of fungi from their host and their identification and classification.

Reference Books:

- Ainsworth, G.E., Sparrow, F. K. and A. S. Sussman.** 1973. The Fungi. Vol. I, II and III. Academic Press, New York.
- Alexopoulos, C.J., C.W. Mims and M. Blackwell.** 1979. Introductory Mycology. A national book foundation, USA
- Aneja K.R.** 1993 : Experiments in Microbiology, Plant Pathology and Tissue New Age international.
- Barnett, H.L.** (1960): Illustrated genera of imperfect fungi. American Phytopathological Society, U.S.A.
- Bessey, E.A.** (1967): Morphology and Taxonomy of fungi Blakiston Company, U.S.A.
- Buller, A.H.R.** (1909-50): Researches on Fungi Vol. I-VIII. Longmans Green & Company, London, U. K.
- Gangopadhyay, S.** (1994): Clinical Plant Pathology. Kalyani Publishers, Daryaganj, New Delhi.
- Gangulee, H. S. and A. K. Kar** (1992): College Botany Vol. II. IV-A and IV-B. New Central Book Agency (P) Ltd., Kolkata. W. B.
- Johanson, D.A.** (1940): Plant Microtechniques. McGraw-Hill Publishing Company Ltd., New York. U. S. A.
- Kendrick, W.B.** (1979): Taxonomy of fungi imperfecti. Uni. Of Toronto Press, Canada
- Pandey, B.P.** (1994): A Text Book of Botany: Fungi. International Publishing House, New Delhi.
- Rangaswamy G.** (1975): Diseases of crop plants in India. PHI Learning Pvt. Ltd., M97 Cannaught Circle, New Delhi.

Raychudhary , S. R. *et al.*(1975): Advances in Mycology and Plant Pathology.

Sharma, O. P. (1989): Text Book of Fungi. Tata McGraw-Hill Education, 1989

Journals

Annual Review of Plant Pathology.

Canadian Journal of Botany.

Mycologia.

Indian Journal of Plant Pathology.

M.Sc. PART- II (SEMESTER III)
PAPER-XI (B O 3.3.3): CYTOGENETICS AND PLANT BREEDING
(SPECIAL PAPER- I) CYTOGENETICS

Total Lectures – 60

UNIT I:

Introduction to cytogenetics. Mitotic and meiotic cell division [5]
Meiosis: modes of meiosis, Chromosome disjunction. Genetic control of meiosis, mechanism and theories of crossing over, Recombination models, Synaptonymal complex [10]

UNIT II:

Structural variations in chromosomes, their cytological consequences, Structural hybrids, B-chromosome its origin and consequences [8]
Numerical variation in chromosomes, sources and consequences including syndromes, classification, natural and induced polyploids [7]

UNIT III:

Genome analysis in crop plants: Wheat, Cotton, Tobacco, Triticale [8]
Meiotic analysis in hybrids [2]
Alien genetic resources in crop improvement: Align addition and substitution lines, transfer of segment from align chromosome, possibilities and limitations [5]

UNIT IV:

Apomixis; types of apomixes in higher plants, significance in plant breeding [7]
Drosophila genetics: Life cycle, special type of chromosome, genetic regulation of development in *Drosophila* [8]

CYTOGENETICS AND PLANT BREEDING

PAPER XI: PRACTICAL COURSE I

UNIT V:

- 1-2. Smear preparations in *Sorghum bicolor*, *Zea mays*, *Delphinium malbaricum*, *Lycopersicum esculentum*, *Coix lachryma-jobi*, *Solanum sp.*
3. Meiotic analysis in plants (Stages, chiasma, chiasma terminalization by using photographs, Pachytene analysis).

4. Meiotic studies in structural hybrids (*Setcreatia* sp *Cyanotis* sp)
5. Study of B chromosome in *Maize/Drimia*
6. Cytological analysis of polyploidy in plants

UNIT VI:

1. Induction of polyploidy using Colchicine.
2. Genome analysis in wheat/*Gossypium*.
- 3-4. Study of life cycle in *Drosophila melanogaster*
5. Special type of chromosomes in *Drosophila melanogaster*

Reference Books:

- Khush G. S.** 1973. Cytogenetics of aneuploides. Academic Press New York USA.
- Burnham C. R.** 1962. Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
- Harti D. L. and Jones E. W.** 1998. Genetics: Principles and Analysis 4th Edition. Jones and Barew Publishers Massachusetts USA.
- Karp G.** 1999. Cell and Molecular Biology : Concepts and Experiments, John Wiley and Sons Inc USA.
- Fikui K. and Nakayama S.** 1996. Plant chromosomes; Laboratory Methods CRC Press Boca Ration Florida.
- Gupta P. K.** 1999. Cytogenetics. Rastogi Publication Meerut.
- Prasad G.** 1998. Introduction to Cytogenetics. Kalyani Publishers, New Delhi.
- Sinha U. and Sinha S.** 1998. Cytogenetics, Plant Breeding and Evolution. Vikas Publishing house Pvt. Ltd. New Delhi
- Swaminathan M. S., Gupta P. K. and Sinha U.** 1974. Cytogenetics of Crop Plants MacMillan India Ltd. New Delhi.
- Swanson C. P., Merz T. and Young J.** 1973. Cytogenetics. Prentice Hill of India Private Ltd. New Delhi.
-

M. Sc. PART- II (SEMESTER III)
PAPER- XI (BO 3.3.4): ENERGY, ECOLOGY & ENVIRONMENT
(SPECIAL PAPER I) ENVIRONMENT AND ITS ASPECTS

Total Lectures: 60

UNIT I:

- Abiotic Environment:** Leibig's Law of Minimum, Law of Limiting Factors. [5]
Environment in Terrestrial Ecosystems: [5]
Atmosphere Climate: Classification of climate, climographs [5]

UNIT II:

Environment in Aquatic Ecosystem

- Marine Environment:** light, waves, currents, winds, tides. [9]
Fresh Water Environment: Wind- currents. [6]

UNIT III:

- Soils:** formation, composition, soil profile, soil types of India. [15]

UNIT IV:

- Land use classification, planning and management, concept of soil map. [7]
Water: Resources and Management. [8]

ECOLOGY PAPER XI: PRACTICAL COURSE I

UNIT V:

1. Analysis of water samples from polluted and non-polluted lakes for DO.
2. Field visits to Industrial area.
3. Study of effect of effluents on plant growth.
4. Determination of BOD at R.T.
- 5-6. Study of wilting coefficient.

UNIT VI:

1. Determination of quality of water by physical parameters (colour, EC, pH, TSS, TDS and TS).
2. Study of MPN as hydrobiological indicator.
- 3-4. Study of soil profile.

5. Determination of organic matter from soil.
6. Ecological instruments used in air and water pollution studies.

Reference Books:

- Agarwal, S. K.** (1992): Fundamentals of Ecology. New Delhi: Ashish Publishing House.
- Bradbury, I. K.** (1990): The Biosphere. Published by John Wiley & Sons, Chichester.
- Das, S. M.** (1989): Handbook of Limnology and water pollution with practical Methodology. Published by South Asian Publishers, New Delhi.
- Etherington, J. R.** (1975): Environment and plant ecology : aims and development. Publisher Wiley.
- Freedman, H. I.** (1980): Deterministic mathematical models in population ecology. Marcel Dekker Inc., New York.
- Greig Smith, P.** (1983): Quantitative Plant Ecology. *Publisher: WILEYBLACKWELL*
- Grims, J. P. et al** (1988) : Comparative Plant Ecology. Colvend, Dalbeattie, Kirkcudrightshire [Scotland] : Castlepoint Press.
- Hashimoto, Y. et al** (1990) : Measurement techniques in plant sciences. San Diego, Calif. : Academic Press
- Kershaw, K. A.** (1964) : Quantitative and dynamic ecology. Publisher: Edward Arnold
- Kormondy, E. J.** (1996) : Concept of ecology. Publisher: Benjamin Cummings.
- Krebs, C. J.** (1978) : Ecology. Harper & Row., New York.
- Lieth, H. F. et al** (1973) : Patterns of primary production in the biosphere. Kluwer Academic Publishers-Plenum Publishers.
- Misra, K. C.** (1989) : Manual of plant ecology. Oxford and IBH Publishing Co., New Delhi.
- Misra, R. and Das, R. R.** (1971) : Proceedings of the school of plant ecology. Publisher: Calcutta Oxford & IBH Pub. Co.
- Odum, E. P.** (1971) : Ecology. Publisher: Saunders
-
- Odum E. P.** (3rd ed. 1996) : Fundamentals of Ecology. Natraj Publishers, Dehra Dun.
- Pandeya S. C. et al** (1963) : Research methods in plant ecology. Asia Publishing House.
- Watt K. E. F.** (1973) : Principles of Environment Sciences. Published by McGraw-Hill.

M. Sc. PART- II (SEMESTER III)

PAPER-XI (BO 3.3.5): ANGIOSPERM TAXONOMY

(SPECIAL PAPER-I) THE EVOLUTION AND CLASSIFICATION OF ANGIOSPERMS

Total Lectures: 60

UNIT I:

Principles and Practices in Plant Taxonomy: Definitions and concepts, importance of taxonomy and need for classification, hierarchical classification, Alpha and Omega taxonomy, taxonomy as synthetic discipline. [5]

The New Global Taxonomy Initiatives: Systematic agenda-2000, systematic knowledge and value of biodiversity, the missions of systematic agenda-2000. Biodiversity strategy and systematics Agenda for 2020. [3]

A Brief History of Pre-Darwinian Classifications: i) Systems based on habit: Theophrastus, Albert Magnus, Otto Brunfels, Jerome Bock, Andrea Cesalpino, Jean Bauhin, Joseph Pitton de Turnefort, John Ray ii) The sexual system: Carolus Linnaeus and his students iii) Systems based on form-relationships: Michel Adanson, Jean B. A. P. M. de Lamarck, De Jussieu, De Candolle, Bentham and Hooker. [7]

UNIT II:

A Brief History of Post Darwinian Classifications: The evolutionary theory by Darwin and Wallace. Systems based on phylogeny i) The Englarian School of thoughts: August Wilhelm Eichler, Adolph Engler, Alfred Rendle, Carl Christian Mez, August A. Pulle, Carl Skottberg, B. Hayata ii) the Ranalian School of thoughts: Richard von Wettstein, Charles E. Bessey, Hans Hallier, John Hutchinson, Oswald Tippe, G. Gundersen, Lyman Benson. [7]

Recent Systems of Classifications: Broad outline of classification by Armen L. Takhtajan and R. M. T. Dahlgren, revised and updated classification of flowering plants by APG-III-Basal angiosperms, magnoliids, monocots, commelinids, eudicots, core eudicots, rosids, fabids, malvids, asterids, lamiids and campanulids. [8]

UNIT III:

Evolution of Flowering Plants: Angiosperm apomorphies- Flower, Stamens, Reduced male gametophyte, Carpel, Two Integuments, Reduced female gametophyte, Endosperm formation, Sieve tube members, Angiosperm specializations, Vessels. Origin of angiosperms [5]

Taxonomic Hierarchy: Ranks of Taxa, Forms of scientific names; major categories: division, class, order, family; minor categories: genus, species and infraspecific categories. [3]

Plant Morphology: Plant structure - Roots, Stems, Leaves, Flowers, Perianth, Androecium, Nectaries, Gynoecium, Carpel, Pistil, Inflorescences, Fruits and seeds. [7]

UNIT IV:

Morphological variations, systematic position, interrelationships, phylogeny and economic importance of following families: ANITA GRADE- Hydatellaceae, Austrobaileaceae; MAGNOLIIDS- Lauraceae, Piperaceae, Aristolochiaceae MONOCOTS- Alismataceae, Hydrocharitaceae, Potamogetonaceae, Aponogetonaceae COMMELINIDS- Commelinaceae, Typhaceae, Eriocaulaceae, Zingiberaceae, Costaceae, Musaceae. [15]

PAPER XI: ANGIOSPERM TAXONOMY: PRACTICAL COURSE I

UNIT V:

1. Exercises on nomenclature problems.
2. Describing new taxon.
- 3-4. Study of flowers of primitive families: Magnoliaceae, Lauraceae, Aristolochiaceae, Piperaceae, Ranunculaceae, Alismataceae, Nymphaeaceae.
5. Identification of wild and cultivated plant species using regional and national floras.
6. Study of different types of ovules and placentations.

UNIT VI:

7-12. Descriptions, Sketching, classification and identification of families: ANITA GRADE- Hydatellaceae, Austrobaileaceae; MAGNOLIIDS- Lauraceae, Piperaceae, Aristolochiaceae; MONOCOTS- Alismataceae, Hydrocharitaceae, Potamogetonaceae, Aponogetonaceae; COMMELINIDS- Commelinaceae, Typhaceae, Eriocaulaceae, Zingiberaceae, Costaceae, Musaceae.

Any additional practical/s based on theory syllabus will be added whenever necessary.

Reference Books:

Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.

- Cronquist, A.** 1988. The Evolution and Classification of Flowering Plants (2nd ed.). Allen Press, U.S.A.
- Davis, P. H. and V. H. Heywood** 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi.
- Manilal, K. S. and M. S. Muktesh Kumar** [eds.] 1998. A Handbook of Taxonomic Training. DST, New Delhi.
- Naik, V. N.** 1984. Taxonomy of Angiosperms. Tata McGraw-Hill, New Delhi.
- Quicke, Donald L. J.** 1993. Principles and Techniques of Contemporary Taxonomy. Blakie Academic & Professional, London.
- Taylor, D. V. and L. J. Hickey** 1997. Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributers, New Delhi.
- Lawrence, G. H. M.** 1951. Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi.
- Takhtajan, A.** 1969. Flowering plants-Origin and Dispersal. Oliver and Boyd, Edinburgh.
- Hutchinson, J.** 1959. Families of Flowering plants. Clarendon Press, Oxford.
- Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue.** 2008. Plant Systematics- A Phylogenetic Approach. Sinauer Associates, INC, Publishers. Sunderland, Massachusetts, USA.
- Simpson, M. G.** 2010. Plant Systematics. Elsevier, Amsterdam.
-

M. Sc. PART- II (SEMESTER III)
PAPER-XI (BO 3.3.6): MARINE BOTANY
(SPECIAL PAPER I) GENERAL MARINE BOTANY

Total Lectures: 60

UNIT I:

Marine environment and organisms: Benthic & Pelagic environment, Classification of marine organisms-Plankton, Nekton, Benthos, Marine Plant Groups [3]

Marine phytoplankton: Classification & diversity, Buoyancy, Red tides [3]

Microbial diversity in marine habitat: Brief idea of Marine Fungi, Actinomycetes, Marine Bacteria & Viruses [4]

Marine Lichens [1]

Coral reefs: Types, Biology, Zooxanthellae, Reef algae & herbivores, Importance. [4]

UNIT II:

Microalgae: Classification & Salient features of Cyanophyta, Pyrrophyta, Chrysophyta, Cryptophyta. Examples from each division. [6]

Macroalgae: Classification of Seaweeds, General characteristics, life cycle & type studies of Chlorophyta (*Ulva*, *Enteromorpha*), Phaeophyta (*Sargassum*, *Padina*) & Rhodophyta (*Gracilaria*, *Porphyra*), Evolution of thallus in different classes. [9]

UNIT III:

Biodiversity of mangroves: Brief idea of Creek, Estuary, Lagoon and Delta. Definition of the term 'mangrove'. Distribution & biogeography of Indian mangroves, East and west coast mangroves, Mangrove shores and forests. [6]

Salient Features of Important Mangrove Families: Rhizophoraceae, Sonneratiaceae, Avicenniaceae, Myrsinaceae, Acanthaceae. Mangrove associates. [9]

UNIT IV:

Salt marshes: Salt marsh flowering plants-Occurrence, Taxonomy, Distribution, Morphological and anatomical adaptations, Ecological roles, Salt marsh ferns, bryophytes, algae. [5]

Sea grasses: Taxonomy, Distribution, Morphological & anatomical adaptations, Ecological roles, Sea grasses & Human affairs. [5]

Sand dunes: Occurrence, Formation of coastal sand dunes .Classification, Embryo dune, Yellow dune, Grey dune, Succession in dune vegetation, Dune vegetation. [5]

MARINE BOTANY PAPER XI: PRACTICAL COURSE I

UNIT V:

1. Study of characteristic features of Chlorophyta Ex. *Enteromorpha*, *Chaetomorpha*, *Ulva*, *Caulerpa*.
 - 2-3. Study of characteristic features of Phaeophyta Ex. *Padina*, *Dictyota*, *Sargassum*.
 4. Study of characteristic features of Rhodophyta Ex. *Gracilaria*, *Gelidium* , *Hypnea*.
 5. Sampling and identification of marine phytoplankton.
 6. Study of sand dune plants (*Canavalia*, *Derris*, *Pandanus*, *Spinifex*, *Ipomoea* etc.).
-

UNIT VI:

1. Type study of mangroves from Avicenniaceae (*Avicennia* species)
 - 2-3. Type study of mangroves from Rhizophoraceae (*Rhizophora*, *Bruguiera*, *Ceriops*, *Kandelia*)
 4. Type study of mangroves from Sonneratiaceae (*Sonneratia*)
 5. Type study of mangroves from Myrsinaceae (*Aegiceras*) and Acanthaceae (*Acanthus*)
 6. Study of important mangrove associates.
-

Reference Books:

- Alexopoulos, C.J. & Bold, H.C.** (1967). *Algae & Fungi: Current Concepts in Biology Series*. The Macmillan Company, London.
- Chapman, V. J.** (1976). *Coastal Vegetation*. II nd edition Pergamon Press. New York
- Chaudhuri. A. B.** (2007). *Biodiversity of Mangroves*.
- Desikachary, T. V.** (1975). *Marine Plants*. N. C. E. R. T. New Delhi.
- Kamat, N. D.** (1982). *Topics in Algae*. Sai Kripa Prakashan, Aurangabad
- Kumar H. D.** 1990. *Introduction to Phycology*. Affiliated East West Press pvt. Ltd. publ. New Delhi.

Kumar H.D. and H.N. Singh (1990). Algae. Affiliated East West Press pvt. Ltd. publ. New Delhi.

McConnaughey, B. H (1974). Introduction to Marine Biology. 2nd ed. Mosby publisher.

Naskar Kumudranjan (2004.) Manual of Indian Mangroves. Daya Publishing House, New Delhi.

Sambamurthy,A.V.S.S.(2005). A Text Book of Algae. I. K. International Pvt. Ltd. New Delhi.

Santhanam, R.; Ramnathan,N.; Venkataramanjan K. & Jegathanam,G. (1987) .

Phytoplankton of Indian Seas. & Aspects of Marine Botany. Daya Publication Home. Delhi.

Sen Neera and Kumudranjan Naskar, (2003). Algal Flora of Sundarbans. Mangal Daya

Stein, J. R. (1973) Handbook of Phycological Methods. Cambridge University Press.

Trainor, F. R. 1978. Introductory Phycology. John Wiley, New York.

Vashishta, B. R. (1995). Algae. S. Chand and Co. Ltd., New Delhi.

M. Sc. PART-II (SEMESTER III)
PAPER-XI (BO 3.3.7): PLANT BIOTECHNOLOGY
(SPECIAL PAPER I) PLANT TISSUE CULTURE

Total Lectures: 60

UNIT I:

Plant tissue culture: Objective and goals of Plant tissue culture; Laboratory design and development, Operation and management [3]

Plant tissue Nutrition: Basic principles of *in vitro* culture, Factors influencing morphogenesis and Physiological significance of tissue nutrition [7]

Media preparation: Media preparation and handling, Sterilization technique, Equipment and apparatus, Procedure of media preparation and stock solution [5]

UNIT II:

Types of Culture: Explant culture, Callus formation and culture, Callus desiccation, Organogenesis, Meristem culture, Axillary bud culture, Protocols and schedule of observation. [10]

Hardening of tissue cultured plants [2]

Protoplast culture and somatic hybridization [3]

UNIT III:

Organ culture: anther/ovary culture, embryo rescuing, synseed [4]

Somaclonal variation; Selection [5]

Cell suspension culture, Cell line isolation [4]

Hairy root culture [2]

UNIT IV:

Green house technology: Construction, operation, maintenance and management [10]

Cryopreservation: Introduction, procedure, importance and future prospects [5]

PLANT BIOTECHNOLOGY PAPER XI: PRACTICAL COURSE I

UNIT V:

1. Media preparation and Sterilization techniques

2. Callus culture
3. Meristem culture
- 4-6. Organogenesis

UNIT VI:

1. Technique of hardening
2. Anther culture
3. Cell suspension culture
4. Embryo rescuing
- 5-6. Visit to commercial greenhouse/ Tissue culture laboratory

Reference Books:

- Bhojwani, S. S. and Razdan, M. K.** 1983. Plant tissue culture, theory and practice. Elsevier Publ.
- Dixon, R. A.** 1985. Plant cell culture- a practical approach. Oril Press Oxford.
- Doddas, J. H. and Rovers, L.W.** 1985. Experiments in plant tissue culture. Cambridge Uni. press.
- Evans *et al.*** 1983. Hand book of plant cell culture vol. I, II, III. McMillan Publ. Co., New York.
- Gamborg, O. L. and Phillips, G. C.** 1966. Plant, tissue and organ culture- fundamental Methods. Narosa Publishing House, New Delhi.
- Narayanswamy, S.** 1997. Plant cell and tissue culture. Tata McGraw Hill Publishers, New Delhi.
- Nelson, P. V.** 1973. Greenhouse operation and management. Reston Publishing Co. Inc.
- Old, R. W. and Primerose, S. B.** 2002. Principles of gene manipulation. Blackwell, Oxford, England.
- Raghavan, V.** 1997. Molecular embryology of flower plants. Cambridge Uni. Press.
- Ravishankar, G. A. and Venkataraman, L. V.** 1997. Biotechnological applications of plant tissue and cell culture. Oxford and IHB Publishing Co. Pvt. Ltd., New Delhi.
- Reddy, S. M., Srivastava, H. P., Purohit, D. K. and Reddy, S. R.** 1997. Microbial biotechnology. Scientific Publishers, Jodhpur, India.
- Reinsert, J. and Bajaj, Y. P. S.** 1976. Plant cell, tissue and organ culture. Springer Verlag, Berlin.
- Street, H. E.** 1974. Tissue culture. Academic Press, New York.
- Thorpe, T. A.** 1981. Plant tissue culture. Academic Press, New York
- Vasil, I. K.** 1984. Cell culture and somatic cell genetics of plants (I). Laboratory procedures and their applications. Academic Press Inc.

M. Sc. PART-II (SEMESTER III)
PAPER-XI (BO 3.3.8): PLANT PROTECTION
(SPECIAL PAPER I) CROP DISEASES AND THEIR MANAGEMENT

Total Lectures: 60

UNIT I:

- Introduction:** History of Plant Pathology and Overview, Crop diseases and losses caused by them. [2]
- Study of major fungal crop diseases:** Study of fungal diseases of following crop plants with respect to distribution, causal organism, symptoms, disease cycle (wherever applicable) and their management
- Cereals:** Udbatta disease of Paddy, Loose smut of Wheat and Rust of Jowar. [3]
- Oil seeds:** Rust of Ground nut and Soybean. [2]
- Pulses:** Anthracnose of Bean. [1]
- Cash crops:** Leaf blotch of Sugar cane, Leaf spot (*Taphrina*) of Turmeric, Rust of Coffee. [3]
- Fruit crops:** Anthracnose of Mango, Downy mildew of Grapes. [2]
- Vegetable crops:** Powdery mildew of Pea, Ripe fruit rot of Chilli. [2]

UNIT II:

Bacterial diseases of crop plants: Introduction, History, Types of Bacterial diseases-Vascular, Parenchyma, Hyperplastic; Entry of bacteria in host; The location of bacteria in diseased tissue, Action of Bacteria on their hosts, Reactions of host; Dissemination of bacterial diseases; Study of bacterial diseases of following crop plants with reference to distribution, Causal organism, Symptoms and effects, etiology, host relations and management:

- a) Paddy: Leaf streak. b) Mango: Leaf spot. c) Tomato: Canker and Wilt. [4]

Mycoplasma (phytoplasmas and spiroplasmas) crop diseases: Features of Mycoplasmas-phytoplasmas, spiroplasmas and L-forms of bacteria; Study of mycoplasma diseases of following crop plants:

- a) Citrus: Citrus greening. b) Tomato: Aster yellow. [3]

Viral diseases of crop plants: Introduction, characteristics of plant viruses, Virus infection and synthesis, translocation and distribution of virus in plants, symptoms of viral diseases, transmission of viruses, epidemiology, purification and serology of plant viruses, Nomenclature and classification of plant viruses, Detection and identification of plant viruses; Study of Sugarcane mosaic and Papaya leaf curl diseases with reference to distribution, causal virus, symptoms, damage, transmission, Host range, control measures. [4]

Angiospermic parasitic diseases: Introduction, Parasitic flowering plants and types of parasitism, Dissemination of angiospermic parasites, Control of angiospermic parasites, classification of parasitic flowering plants, Study of following parasitic angiospermic plants with reference to disease symptom, pathogen, host range, Development of disease and management. as diseases of crop plants

- a) *Loranthus* b) Dodder. c) Broomrape. d) Witchweed. [4]

UNIT III:

Plant disease epidemiology: Pathometry. Epidemic avoidance by means other than chemicals. [6]

Post harvest market diseases of important fruit and vegetable crops. [4]

Seed Pathology –Biodeterioration and mycotoxins; methods of seed treatment- mode of action of various chemicals and *Trichoderma*. Seed borne pathogens of pigeon pea and their control [5]

UNIT IV:

Pathogenesis: Pathogenesis and host-parasite specificity in plant diseases, Pathogenesis and host-parasite specificity in *Phytophthora*, Rusts, Downy mildew fungi, Powdery mildew and Nematodes. [5]

Enzymes and toxins in plant diseases: Chemical weapons of pathogenesis.

Enzymes: - Enzymes in plant diseases, Enzymes for waxes and cutins, Pectic enzymes, Cellulolytic enzymes, Hemicellulases, Lignolytic enzymes, Proteolytic enzymes, Lipolytic enzymes and Interaction of enzymes.

Toxins: -Introduction-Toxins and plant diseases, and Classification of toxins [5]

Effects of pathogen on the physiology of the host plant: Effects on permeability of cell membrane, Translocation of water and nutrients in host plant, Transcription and translation, host plant respiration and photosynthesis. [5]

PLANT PROTECTION PAPER XI: PRACTICAL COURSE I

UNIT V Following diseases should be studied with respect to causal organism, symptoms, disease cycle (wherever applicable) and their management

- 1.Udbatta disease of paddy, Brown rust of Wheat
- 2.Loose smut of Wheat, Rust of Jowar
3. Rust of Ground nut, Powdery mildew of Pea.
- 4.Anthracnose of Bean, Rust of Soybean.
- 5.Leaf blotch of Sugarcane, *Taphrina* leaf spot of Turmeric
- 6.Rhizome rots of Turmeric, Anthracnose of Mango

UNIT VI

- 1.Downy mildew of Grape, Leaf spot of Brinjal
- 2.Ripe fruit rot of Chili; Bacterial, Mycoplasma, viral and Angiospermic parasitic diseases.
- 3.Market diseases of vegetables (available in local market)
- 4.Market diseases of fruits (available in local market)
- 5.Recording the percentage of infection by Cobb's (1892) method in given infected crop for disease epidemiological study.
- 6.Study of the various methods of seed treatment and chemicals, bio-agents used in seed treatment.

Reference Books:

- Agrios, G. N.** (1997). Plant Pathology, 4th Edn. Academic press, San Diego
- Aneja K. R.:** Experiments in Microbiology, Plant Pathology and Tissue Culture. Wishwa publishers
- Aneja, K. R** (2005). Experiments in Microbiology and Plant Pathology and biotechnology. New Age International (P) Ltd. Publishers, New Delhi.
- Atwal, A. S.** (1936) Agricultural Pest of India and South East Asia. Kalyani Publishers, New Delhi
- Baruah H. K.,** P Brain and A. Baruah, (1984). Textbook of plant pathology. Oxford and IBH Publ. Co., New Delhi.
- Bilgrami K. S. and Dube H. C.** (1990). Text book of Modern pathology. Vikas Publishing House Pvt. Ltd. New Delhi.
- Chandrashekharan S. N. and S. V. Parthasarthy** (1965). Cytogenetics and Plant Breeding. P. Varadachary and Co. Madras.
- Chatterjee P. B.** (1997). Plant Protection Techniques. Bharti Bhawan. Patana
- Chatterjee, P. B.** (1997) Plant protection techniques. Bharati Bhawan Publishers and Distributors Patna.
- Chattopadhyaya, S. P.** (1987) Principles and Procedures of Plant Protection. Oxford and IBH, New Delhi.
- Dhaliwal, G. S. and Arora Ramesh** (1994) Trends in Agricultural Pest Management. Commonwealth Publishers, New Delhi.
- Dickinson M.** (2008). Molecular Plant Pathology. BIOS Scientific Publishers, London and New York.
- Dickson, M. J. and J. Beynon** (2000). Annual Plant Reviews, Volume 4-Molecular plant Pathology. Sheffield Academic press, Sheffield.
- Dickson J. C.** (1964) Diseases of Field crop. McGraw –Hill, New Delhi.
- Gerhardson, B** (2002). Biological substitutes for pesticides. *Trends in biotechnology* **20**:338-343. ICAE, Publication.: Crop Diseases Calendar
- Jha, L. K.** (1987) Applied Agricultural Entomology. New Central Book Agency, Calcutta.
- Jones D. G.** (1987) Plant pathology – Principles and practices. Open University Press, Stratford.
- Mehrotra R. S. and Ashok Aggarwal** (2005) Plant Pathology. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Mehrotra, R. S.** (1980). Plant pathology. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Metcalf, C. L. and Flint, W. P.** (1983) Destructive and Useful Insects. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Nagarajan S.** (1999) Plant Diseases and Epidemiology. Oxford and IBH, New Delhi.
- Nagarajan, S. and K. Mualidharan** (1995) Dynamics of Plant Diseases. Allied Publishers, New Delhi .
- Pathak V. N.** (1980) Diseases of Fruit crops. Oxford and IBH, New Delhi.
- Pedigo, L. P.** (1996) Entomology and pest Management. Prentice-Hall Pub. Englewood cliffs NJ
- Punja, Z. K.** (2001). Genetic engineering of plants to enhance resistance to fungal pathogens-a review of progress and future prospects. *Canadian Journal of plant pathology* **23**: 216-235.
- Ramakrishnan T. S.** (1974) Diseases of Millets. ICAR, New Delhi.
- Rangaswami, G.** (1975) Diseases of crop plants in India. Prentice-Hall Pub, New Delhi.
- Rao V. S.** (1987) Principles of Weed Science. Oxford and IBH, New Delhi.

- Rashid S. N.** and M. M. A. Khan : Dictionary of Remote Sensing. Manak Publication Pvt. Ltd., New Delhi.
- Roberts D. A.** and Bothroyd C. W. (1995) Fundamental Plant Pathology. W. H. Freeman & Co
- Rommens, C. M.** and G. M. Kishore (2000). Exploiting the full potential of disease resistance genes for agricultural use. *Current Opinions in Biotechnology* **11**:120-125.
- Saha L. R.** (1990) Hand Book of Plant Protection. Kalyani Publ. New Delhi.
- Saha, L. R.** and Dhaliwal G. S. (2006) Handbook of Plant Protection. Kalyani Publ. New Delhi.
- Sambamurty, A. V. S. S.** (2008). Molecular biology. Narosa Publishing House, New Delhi. ISBN 978-81-7319-837-3.
- Schillberg, S., S. Zimmermann, M. Y. Zhang and R. Fisher** (2001). Antibody-based resistance to plant pathogens. *Transgenic research*.**10**:1-12.
- Shrivastava, V. P.** (1988). A Textbook of Applied Entomology. Kalyani Publ. New Delhi
- Sill Webster H.** (1983). Plant Protection. Iowa State Univ.Press
- Singh Tribhuwan and K. Agarwal** (2001). Seed Technology and Seed Pathology, Pointer Publishers, Jaipur-302003 (Raj), India. ISBN 81-7132-284 -0
- Singh, R. S.** (1998) Plant Diseases. Oxford & IBH Publ.
- Singh, R. S., U. S. Singh, W. M. Hess and D. J. Weber** (1988). Experimental and conceptual plant pathology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- Stuiver, M. H. and J. H. H. V.Custers** (2001). Engineering disease resistance in plants. *Nature* **411**: 865-868.
- Suryanaryana, D.** (1974) Seed pathology. Vikas New Delhi
- Tepfer, M.** (2002). Risk assessment of Virus-resistant transgenic plants. *Annual Review of Phytopathology***40**:467-491.
- Journals :** 1. Crop Protection 2. Geobios 3. Journal of Entomological Society of India.
-
-

M. Sc. PART-II (SEMESTER III)
PAPER-XI (BO 3.3.9): PLANT DIVERSITY
(SPECIAL PAPER I) INTRODUCTORY BIODIVERSITY

Total Lectures: 60

UNIT I:

Introduction to biodiversity: Concept, definition, importance of biodiversity, global biodiversity, status in India, biodiversity values. Diversity of plant Groups (Viruses, Bacteria, Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms) [8]

Levels of biodiversity: Species diversity: species richness, species evenness, alpha diversity, beta diversity, gamma diversity, **Genetic diversity:** Concept, terminology used- eco-clines, ecotypes, chemotypes, cytotypes, varieties, subspecies, polytypic, monotypic and hybrids. **Ecological diversity:** Concept, Raunkaier's life forms, taxonomic and functional diversity, synecology and autoecology. [7]

UNIT II:

Characterization of biodiversity Meaning of characterizing biodiversity, taxonomic and evolutionary characterization, characterizing flora and fauna, preparing floras, hand books, monographs, keys and database, biological concept of species. [8]

Magnitude and distribution of biodiversity: Gradients of biodiversity (latitudinal, altitudinal, depth), environmental factors and centres of diversity, the diversity of introduced and domesticated species, rarity, endemism and biodiversity, speciation and extinction. [7]

UNIT III:

Plant biodiversity and ecosystem functioning: Concept, types-forest, grassland, desert and aquatic, functional attributes of an ecosystem, biological diversity and maintenance of stability, primary and secondary productivity, food chain, energy flow, material cycling, homeostasis and feedback, ecosystem services and dynamics of biodiversity. [8]

Biodiversity crisis: Concept, causes of biodiversity loss, destruction of ecosystem, adverse changes in biotic and abiotic environment due to pollution, over exploitation of species, habitat fragmentation, exotic species, natural calamities, chain extinctions, change in climate and biodiversity. [7]

UNIT IV:

Biodiversity of India: India as mega biodiversity centre, hot spots of India, Biogeographic regions, plant diversity of western ghat with reference to geographical position, climate, area, districts, forest types, forest products, endemism and RET plants. Western Ghat as megadiversity centre. Red data book species of Western Ghats, World heritage: Kas Plateau. [15]

PLANT DIVERSITY PAPER XI: PRACTICAL COURSE I

UNIT V:

1. Preparation of maps showing biogeographic regions, hot spots of India, megabiodiversity centres of the world
2. Study of comparative diversity in bacteria and viruses
3. Study of comparative diversity in Algae
4. Study of comparative diversity in Fungi
5. Study of comparative diversity in Bryophytes
6. Study of comparative diversity in Pteridophytes

UNIT VI:

1. Study of comparative diversity in Gymnosperms
- 2-4. Study of comparative diversity in Angiosperms (Leaves, Inflorescence, Flowers, Fruits and Seeds)
5. Use of database in studying biodiversity
6. Study of vegetation type according to Raunkaier's Life forms

Reference Books:

Heywood V. H. and Watson R. T. (Edt) 1995 Global Biodiversity Assessment; University Press

Prashanth M. S. and Hosetti B. B. 2010 Elements of Environment Science; Prateeksha Publications

Dash M. C. 2001 Fundamental of Ecology; Tata McGraw-Hill Education

Belsare D. K. 2007 Introduction to Biodiversity; APH Publishing

Bharucha Erach 2005 Textbook of Environmental Studies; Universities Press

Rao, R. R. 1994. Biodiversity of India (Floristic Aspects). Bishen Singh Mahendra Pal Singh, Dehra-Dun.

M. Sc. PART-II (SEMESTER III)
PAPER-XII (B O 3.4.1): PLANT PHYSIOLOGY
(SPECIAL PAPER II) PLANT GROWTH AND DEVELOPMENT

Total Lectures: 60

UNIT I:

Growth and morphogenesis: Photomorphogenesis; History and discovery of phytochromes and cryptochromes and their photochemical and biochemical properties. phytochrome biosynthesis, cellular localization, roles, mechanism of action of photo morphogenetic receptors. [15]

UNIT II:

Pollen germination: Physiology of pollen germination and pollen-pistil interaction. [5]

Senescence and PCD: Biochemical changes during senescence of leaves and petals. Regulation of senescence, Programmed Cell Death. [6]

Seed Development: Biochemical changes during seed development. [4]

UNIT III:

Post harvest physiology: Ripening of fruit and its regulation. Metabolism of leafy vegetables during storage. [9]

Role of biotechnology and mutants in physiological studies. [6]

UNIT IV:

Plant growth regulators: Discovery, role and possible mechanism of action of Triaccontanol, Brassins, Salicylic acid, Jasmonates and Polyamines. Role of plant growth retardants- CCC, Maleic hydrazide, Trizoles and TIBA. [15]

PLANT PHYSIOLOGY PAPER XII: PRACTICAL COURSE II

UNIT V:

- 1-2. Hormonal regulation of leaf and petal senescence.
- 3-4. Study of changes in RNA and Proteins during senescence.
5. Study of changes in starch content during seed development.
6. Study of changes in protein content during seed development.

UNIT VI:

1. Study of enzyme pectinase/pectin methyl esterase during ripening of fruit.
2. Study of changes in respiration rate during ripening of fruits.
3. Study of lipid accumulation during development of oil seeds.
4. Effect of chemical compounds on pollen germination.
- 5-6. Study of effect of different PGRs on seedling growth and vigour.

Reference Books:

Bidwell, R. C. S. (1979): Plant Physiology. Macmillan

Bonner, J. and Varner, J.E. (1972): Plant Biochemistry. IBH.

Edwards G. and Walker D., eds. (1983). C3, C4: mechanisms, and cellular and environmental regulation, of photosynthesis. Oxford: Blackwell Scientific Publications.

Govindjee, H. (ed.) (1982): Photosynthesis, Vol. 1 and Vol. 2. Academic Press, N.Y. (Vol. 1); 0-12- 294302-2 (Vol. 2))

Hopkins, W. C. (1995): Introduction to Plant Physiology. Wiley, New York.

Krishnamurthy, H.N. (1992): Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.

Marschner, H. W. (1986): Mineral nutrition of Higher Plants. First Edition, Academic Press, Elsevier Science Ltd.

Marschner, H. W. (2003): Mineral nutrition of Higher Plants. Second Edition, Academic Press, Elsevier Science Ltd.

Moore, T.C. (1974): Research experience in Plant Physiology, A Laboratory manual. Springer-Verlag, Berlin.

Mukherjee, S.P. and Ghosh A.N. (1996): Plant Physiology. New Central Book Agency (P) Limited Tata McGraw Hill.

Noggle, G.R. and Fritz, G. J. (1976): Introductory Plant Physiology. Prentice- Hall, Inc., Englewood Cliffs, NJ.

Pessaraki, M. (Ed.). (2001). Handbook of Plant and Crop Physiology, 2nd Edition, Revised and Expanded. Marcel Dekker, Inc., New York

Pessaraki, M. (Ed.). (2005). Handbook of Photosynthesis, 2nd Edition, CRC Press, Taylor & Francis Publishing Company, Florida

Randhir Singh and Sawhney S. K. (1988): Advances in frontier Areas of Plant Biochemistry. Prentice Hall of India

Sadasivam S. and Manickam A. (1996): Biochemical methods. New Age International.

Salisbury, F. B. and Ross, C.W.(1992): Plant Physiology IV ed. Cengage Learning

Smith, H. (1975): Phytochrome and Photomorphogenesis. McGraw-Hill Inc.,US

Taiz, L. and Zeiger, F. (1998): The Plant Physiology. Second Edition, Sunderland: Sinauer Associates.

Wilkins, M. B. (1976): Physiology of Plant Growth and Development. McGraw-Hill Publishing Company Limited

Journals

Annual Review of Plant Physiology and Molecular Biology

Annual Review of Plant Physiology

Indian Journal of Plant Physiology

Journal of Experimental Botany

Physiologia Plantarum, Sweden

Plant Physiology, Bethesda, USA

Plant Cell

M. Sc. PART-II (SEMESTER III)
PAPER-XII (BO 3.4.2): MYCOLOGY AND PLANT PATHOLOGY
(SPECIAL PAPER II) INTEGRATED DISEASE MANAGEMENT

Total Lectures: 60

UNIT I:

Principles of plant pathology: History, Classification of crop diseases. Deficiency of micronutrients. [5]

Seed pathology: Methods of detection of internal and external seed borne Fungi, Bacteria and Viruses, biodeterioration and mycotoxins. [10]

UNIT II:

Role of enzymes and toxins in disease development. Cell wall degrading enzymes: Cellulolytic, Pectolytic, Proteolytic and Lipolytic. Toxins: lycomarsmine, alternic acid, Fusaric acid, Piricularin, Victorin and aflatoxins. [15]

UNIT III:

Physiology and Biochemistry of host pathogen interaction: Respiration, Photosynthesis, Proteins, Nucleic acids, phenols and plant growth regulators. [15]

UNIT IV:

Genetics of host pathogen interaction, gene for gene hypothesis, protein for protein hypothesis, antigen and antibody reaction. Immunoglobulins, application of immunological techniques, physiological specializations. [15]

MYCOLOGY AND PLANT PATHOLOGY PAPER XII: PRACTICAL COURSE II

UNIT V:

- 1-3. Estimation of fungal enzyme (Cellulases, Amylases and Pectinases).
4. Estimation of nucleic acids from healthy and infected plants.
5. Use of biocontrol agents (*Trichoderma* spp.) against plant pathogens.
6. Extraction and detection of aflatoxins from infected seeds.

UNIT VI:

1. Estimation of protein from healthy and infected plants.

- 2-3. Study of external and internal seed mycoflora.
4. Immunological techniques-purification and fragmentation of immunoglobulins.
- 5-6. Symptomology and histo-pathology of diseases mentioned in the theory.

Reference Books:

- Agrios, G. N.** (2006). Plant Pathology (5th Edition). Academy Press, London.
- Aneja, K. R.** (1993). Experiments in Microbiology, Plant Pathology and Tissue Culture. New Age international.
- Cooke, A. A.** (1981). Diseases of Tropical and Subtropical Field, fiber and Oilplants.
- Gangopadhyay, S.** (1994). Clinical Plant Pathology. Kalyani Publishers, Daryaganj, New Delhi.
- Gangulee, H. S. and Kar, A. K.** (1992). College Botany Vol. II. New Central Book Agency (P) Ltd., Kolkata. W. B.
- Jha, D. K.** (1993). A text book on Seed Pathology. Vikas Publishing House Pvt. Ltd., 576 Masjid Road, Jangpura, New Delhi-110014.
- Kuljit, J.** (1969). The Biology of parasitic flowering plants. Uni. Of California Press, U. S. A.
- Mahadevan, A. and Shridhar, R.** (1982). Methods in Physiological Plant. PHI Learning Pvt. Ltd., M97 Cannught Circle, New Delhi.
- Mehrotra, R. S.** (1980). Plant Pathology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- Nair, L. N.** (2007). Topics in Mycology and Plant Pathology. New Central Book Agency (P) Ltd., Kolkata. W. B.
- Neergard, P.** (1977). Seed Pathology. Vol. I & II, Macmillan Press, London.
- Nyvall, R. F.** (1979). Field Crop Diseases Handbook.
- Padoley, S. K. and Mistry, P. B.** A manual of plant Pathology.
- Paul Khurana, S. M.** (1998). Pathological problems of Economic Crop Plants and their Management.

Plank, J. E. Vander(1968). Plant Diseases, Epidemics and Control. Academy Press, London.

Plank, J. E. Vander(1968). Disease Resistance in Plants. A. P. London and New York.

Rangaswamy, G. (1975): Diseases of crop plants in India. Diseases of crop Plants in India. PHI Learning Pvt. Ltd., M97 Cannaught Circle, New Delhi.

Singh, R. S. (1963): Plant Diseases. Oxford and IBH Publishing

M. Sc. PART- II (SEMESTER III)
PAPER-XII (BO3.4.3): CYTOGENETICS AND PLANT BREEDING
(SPECIAL PAPER II) PLANT BREEDING

Total Lectures: 60

UNIT I:

Objectives of Plant Breeding, Domestication, Selection under domestication; Introduction, Quarantine; and Acclimatization of plants, Germplasm: Gene pool concept, Genetic erosion, Exploration and collection of germplasm, conservation and utilization, Mechanism of pollination control: self-incompatibility and male sterility [10]

UNIT II:

Inheritance of qualitative and quantitative characters, Biometrical techniques in plant breeding: Introduction, Assessment of variability, Components of variance, Genetic diversity, QTL and linkage maps [4]

UNIT III:

Aids to Selection: Correlation coefficient analysis, Path analysis and Discriminant functions. Choice of parents and breeding procedures: Diallele, Partial diallele, Triallele, Line tester, Generation mean analysis, Biparental cross analysis with various designs and Varietal adaptation [10]

UNIT IV:

Breeding for biotic and abiotic stresses: Disease and Insect resistance; Drought, Salinity, Heat and cold resistance. Mutation breeding [5]

CYTOGENETICS AND PLANT BREEDING PAPER XII: PRACTICAL COURSE II

UNIT V

1. Germplasm collection, cataloguing, data storage and retrieval
2. To study crossability between cultivars
3. Study of pollen germination and demonstration of incompatibility.
4. Study of cytoplasmic male sterility
- 5-6. Designing field experiments

UNIT VI

1. Metroglif analysis
2. D^2 analysis
3. Estimation of heritability
4. Screening of germplasm for biotic and abiotic stresses
- 5-6. To study the effect of mutagen on germination, seedling growth and on mitosis

Reference Books:

- Singh, B. D.** 2000. Plant breeding- Principles and methods. Kalyani Publishers, Ludhiana.
- Sharma, J. R.** 1994. Principles and practice of plant breeding. Tata McGraw Hill Publ. Co. Ltd., New Delhi.
- Siddiqui B. A. and Khna S.** 1999. Breeding in crop plants. Mutation and In vitro mutation breeding . Kalyani Publishers New Delhi
- IAEA 1995.** Induced mutations and Molecular techniques for crop improvement. Proc FAO/IAEA Symposium Vienna
- IAEA 1991.** Plant Mutation Breeding crop improvement Proc. FAO/IAEA Symposium (Vol 1&2)Vienna
- Micke A.** 1991. Induced Mutation for crop improvement. Gamma Field Symposia No.30 Institute of Radiation Breeding Pullman USA.
- Allard R. W.** 1960. Principles of Plant Breeding John Wiley and Sons, New York.
- Hays H. K., Immer F.R. and Smith D.C.** 1955. Methods of Plant Breeding. McGraw Hill Book Company Inc New York.
- Fehr W. R.** 1987. Principles of Cultivar Development (2 Volumes) MacMillan Publishing Co. New York.
- Poehlman J.M.** 1986. Breeding Field Crops AVI Publishing Company Connecticut. NEW YORK
- Sharma J. R.** 1998. Statistical and Biometrical techniques in Plant Breeding New Age International Publishers New Delhi.
- Singh R. K. and Singh B. D.** 1997. Biometrical Methods in Quantitative genetic Analysis. Kalyani Publishers, New Delhi.
- Vijendra Das L. D.** 2000. Problems Facing Plant Breeding CBS Publishers New Delhi
- Rosielle A. A. and Hamblin J.** 1981 Theoretical aspects of selection for yield in stress and non-stress environments Crop Sci, 21: 932-946.
- Levitt J.** 1980. Response of Plants to Environmental Stress: Water, Salt and Other stresses. Academic Press, New York.
- Bulm A.** 1988. Plant Breeding for stress Environments. CRC Press Florida.
- Chopra V. L.** 1989. Plant Breeding .oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Roy Darbeshwar** 2000, Plant breeding analysis and exploitation of variance. Narosa Publishers New Delhi.

Journals:

Indian Journal of Genetics and Plant Breeding.

Journal of Genetics
Caryologia
Journal of Cytology and Genetics
International Journal of Food Science and Technology
Cytologia
International Journal of Plant Breeding

M.Sc. PART- II (SEMESTER III)

**PAPER-XII (BO 3.4.4): ENERGY, ECOLOGY AND ENVIRONMENT
(SPECIAL PAPER II) POPULATION AND COMMUNITY ECOLOGY**

Total Lectures: 60

UNIT I:

Population Ecology: Population regulation, Density dependent and Independent regulation: Role of different factors, Genecology-Ecads, Ecotypes, concept of niche etc. Human population dynamics and prediction. [15]

UNIT II:

Community Ecology: Community as a Unit: Clementsian unit of vegetation. [4]

Community Nature: Individualistic and organismic nature of communities, community stratification. [11]

UNIT III:

Functional Aspects of Community: Community Metabolism, Community Periodism. [6]

Community Sability: Maturation of Communities, Regulation of communities,

Community Stability: Ecotone and Edge effect. [6]

Community as Indicator. [3]

UNIT IV:

Statistical thinking in Ecology:

Ecosystems and scale, theory, knowledge and research design, Ecological study unit, Inference methods, Experimental versus observation methods in ecology, Evidence and hypothesis testing, formulating right problem, Publish or Perish. [15]

ECOLOGY PAPER XII: PRACTICAL COURSE II

UNIT V:

1. Study of litter production.
2. Determination of similarity index and association index.
3. Study of stratification and physiognomy.
4. Study of population dynamics.
5. Determination of IVI.
6. Study of α , β diversity.

UNIT VI:

1. Study of vegetation by transect method.
2. Study of vegetation bisects.
3. Measurement of biomass production.
- 4-5. Biomass profile of the plant community.
6. Visit to local protected or conserved area.

Reference Books:

- Abe, T., Levin, S. A. and Higashi, M.** (1997) (ed.): Biodiversity an Ecological Perspective. Springer Verlag.
- Bradbury I.K.** 1990): The Biosphere.
- Brij Gopal and Bhardwaj, N.** (1979): Elements of Ecology. Sahibabad: Vikas Publishing House PVT. Ltd.
- Galston, K. J.** (1996): Biodiversity: A biology of numbers and differences. Kluwer Academic *Publishers*, Dordrecht, the Netherlands.
- Greig Smith P.** (1983): Quantitative Plant Ecology. *Publisher:* WILEYBLACKWELL
- Hamson, H. C. and Churchill, E. D.** (1961): The Plant Community. Reinhold *publishing* corporation, New York.
- Hashimoto Y et al** (1990) : Measurement techniques in plant sciences. San Diego, Calif. : Academic Press.
- Kormondy E. J.** (1996) (4th ed.): Concept of ecology. Publisher: Benjamin Cummings.
- Krattiger, A. I. et al** (1994): Widening Perspectives on Biodiversity. Kluwer Academic *Publishers*.
- Krebs C. J.** (1978) : Ecology. Harper & Row., New York.
- Misra K. C.** (1989) : Manual of plant ecology. Oxford and IBH Publishing Co., New Delhi.
- Nair, P. K. G.** (1990): Principles of Environmental Biology. Himalaya *Publishing* House (Bombay).
- Odum E. P.** (3rd ed. 1996) : Fundamentals of Ecology. Natraj Publishers, Dehra Dun.
- Pandeya S. C., Puri, G. S. and Singh, J. S.** (1968) : Research methods in plant ecology. Asia Publishing House.
- Shukla, R. S. and Chandel, P. S.** (1983): Plant Ecology. Oxford and IBH *publishers*, New Delhi, India.
- Walter, H.** (1979); Vegetation of the Earth and Ecological Systems of Geobiosphere. Springer, New York.
- Weaver, J. E. and Clements, F. S.** (1938): Plant Ecology. Springer, New York.
- Willis, A. J.** (1973): Introduction to Plant Ecology. *Willis A J. Publisher.*
- Yadav, P. S. and Singh, J. S.** (1997): Progress in Ecology vol. II. Today & Tomorrow's Printers & *Publishers*, New Delhi.

M. Sc. PART-II (SEMESTER III)
PAPER-XII (BO 3.4.5): ANGIOSPERM TAXONOMY
(SPECIAL PAPER II) MODERN TRENDS IN ANGIOSPERM TAXONOMY
Total Lectures: 60

UNIT I:

Embryology in relation to taxonomy: Embryological characters of taxonomic importance, utilisation of embryological data in solving taxonomic problems at different levels.

[5]

Anatomy in relation to taxonomy: Vegetative, wood and floral anatomy, anatomical characters of taxonomic importance, use of anatomical data in understanding interrelationship and evolution of angiosperms and solving taxonomic problems.

[5]

Palynotaxonomy: Pollen morphology-Polarity, symmetry, NPC of pollen, exine stratification, excrescences, L/O pattern, palynogram; pollen characters of taxonomic importance.

[5]

UNIT: II

Cytotaxonomy: Chromosome number, Basic chromosome number, polyploidy, aneuploidy, chromosome morphology, karyotype, chromosome banding, meiotic analysis and plant systematics, scope and limitations.

[7]

Chemotaxonomy: Origin of chemotaxonomy, classes of compounds and their biological significance, Stages in chemotaxonomic investigations, techniques, Use of chemical criteria in plant taxonomy; Proteins and taxonomy: seed proteins, techniques of protein electrophoresis, protein analysis procedures, analysis of amino acid sequence and its significance in systematics; serology and taxonomy: history, precipitation reaction, techniques, antigen, antisera, antibody, application of serological data in systematics.

[8]

UNIT: III

Ultrastructural systematics: SEM and TEM studies and plant systematics; SEM and plant surface structure, TEM and dilated cisterneae of endoplasmic reticulum and sieve element plastids, applications of data in the classification of higher taxa.

[3]

Molecular Systematics: Molecular diagnostic tools, Restriction Fragment Length Polymorphism (RFLPs), Random Amplified Polymorphic DNA (RAPD), Polymerase Chain Reaction (PCR) analysis, specific applications of RAPD, AFLP in molecular systematics.

Molecular data and systematic position of Hydatellaceae.

[7]

Plant geography, ecology and systematics: Patterns of geographic distribution, Disjunction and Vicariance, Vicariance biogeography, Endemism, Centres of diversity, Ecological differentiation, Alien plants, Phenotypic plasticity [5]

UNIT: IV

Morphological variations, systematic position, interrelationships, phylogeny and economic importance of following families: EUDICOTS-Menispermaceae, Ranunculaceae, Nelumbonaceae; CORE EUDICOTS- Nyctaginaceae, Portulacaceae, Polygonaceae, Loranthaceae, Santalaceae; ROSIDS-Vitaceae, Zygophyllaceae, Oxalidaceae, Euphorbiaceae, Rhizophoraceae, Passifloraceae, Polygalaceae. [15]

ANGIOSPERM TAXONOMY PAPER XII: PRACTICAL COURSE II

UNIT V:

1. Microtome technique for study of embryological characters
2. Study of wood characters: vessels, storied and nonstoried wood
3. Semipermanent pollen preparations by acetolysis and study of different pollen morphotypes.
4. Study of chromosomes and Karyotype analysis.
- 5-6. Interpretation of flavonoid data for taxonomy using PC/TLC/ protein profile analysis.

UNIT VI:

1. Exercise on Numerical taxonomy
2. Study of plant surface attributes with the help of SEM photographs and sieve tube plastid and dilated cisternae of endoplasmic reticulum with the help of TEM photographs
- 3-6. Descriptions, Sketching, classification and identification of families: EUDICOTS-Menispermaceae, Ranunculaceae, Nelumbonaceae; CORE EUDICOTS- Nyctaginaceae, Portulacaceae, Polygonaceae, Loranthaceae, Santalaceae; ROSIDS-Vitaceae, Zygophyllaceae, Oxalidaceae, Euphorbiaceae, Rhizophoraceae, Passifloraceae, Polygalaceae.

Any additional practical/s based on theory syllabus will be added whenever necessary.

(Atleast two local tours should be arranged to study vegetation, ecology and flowering of the region in first term. Student is supposed to submit herbarium specimens (50) and plant materials in the form of slides (5) and preserved specimens.)

Reference Books:

- Bhojwani, S. S. and Bhatnagar, S. P. 1984.** Embryology of Angiosperms. Vikas Publ. House, New Dehli.
- Cronquist, A. 1988.** The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A.
- Cronquist, A. 1981.** An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
- Davis, P. H. and V. H. Heywood 1991.** Principles of Angiosperm Taxonomy. Today and Tommorrow Publications, New Delhi.
- Erdtman, G. 1952.** Pollen Morphology and Plant Taxonomy. Angiosperms. Almquist and Wiksell. Stockholm.
- Fahn, A. 1979.** Plant Anatomy, Pergamon Press, London.
- Erdtman, G. 1952.** Pollen Morphology and Plant Taxonomy. Angiosperms. Hafner Publ. Co. New York.
- Johri, B. M. 1984.** Comparative embryology of Angiosperms. Ind. Nat. Sc. Acad. New Delhi.
- Maheshwari, P. 1985.** An Introduction to Embryology of Angiosperms. Tata McGraw Hill, New Delhi.
- Manilal, K. S. and M. S. Muktesh Kumar [ed.] 1998.** A Handbook of Taxonomic Training. DST, New Delhi.
- Naik, V. N. 1984.** Taxonomy of Angiosperms Tata McGraw-Hill, New Delhi.
- Nair, P. K. K. 1966.** Pollen morphology of Angiosperms. Periodical Expert Book Agency, New Delhi.
- Quicke, Donald, L. J. 1993.** Principles and Techniques of Contemporary Taxonomy. Blakie Academic & Professional, London.
- Taylor, D. V. and L. J. Hickey 1997.** Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributers, New Delhi.
- Lawrence, G. H. M. 1951.** Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi .

- Paech, K. and M. V. Tracey. 1956.** Modern Methods of Plant Analysis. Vol-I & II. Springer-Verlag.
- Shivanna, K. R. and N. S. Rangaswamy. 1992.** Pollen Biology- A Laboratory Manual. Springer-Verla
- Sharma A. K. and A. Sharma. 1980.** Chromosome Technique: Theory and Practices (3rd ed.) Butterworths, London.
- Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue 2008.** Plant Systematics-A Phylogenetic Approach Sinauer Associates, INC,Publishers.Sunderland, Massachusetts, USA.
- Simpson, M. G. 2010.** Plant Systematics. Elsevier, Amsterdam.
- Stace, C. A. 1989.** Plant Taxonomy and Biosystematics. Edward Arnold, London.

M. Sc. PART-II (SEMESTER III)
PAPER-XII (BO 3.4.6): MARINE BOTANY
(SPECIAL PAPER II) PHYSIOLOGY AND BIOCHEMISTRY OF
MARINE PLANTS

Total Lectures: 60

UNIT I:

Photosynthesis in Marine Algae: Overview, light harvesting, Photosynthetic pigments (chlorophylls, phycobiliproteins, carotenoids), effect of low light condition. Photosynthetic carbon fixation- Dark Reactions, Inorganic carbon sources and uptake, Photosynthetic pathways in seaweeds, Light independent carbon fixation, C₃ versus C₄ characteristics of seaweeds. Carbon metabolism and calcification [8]

Storage and Structural Components in Algae: Seaweed polysaccharides Alginates, Agars, Carrageenans, Fucoidan, Laminaran, Xylans, Mannans, Algal Starches Polysaccharide synthesis, Low Molecular Weight compounds in algae-Fatty acids, Lipids, Steroids, Triterpenoids etc. [7]

UNIT II:

Salt Regulation in Halophytes: Salt regulation strategies, salt secretion through glands Ultrastructure of salt glands, Salt glands in mangroves, Mechanism of salt secretion, Salt retransportation, Salt bladders, Leaf succulence, Selective ion absorption. [6]

Salinity and Metabolism:

Water relations, osmoregulation and photosynthesis in mangroves. Significance of vivipary in mangroves [5]

Salinity and Water relations in seagrass communities. [2]

Salinity, salt regulation and photosynthesis in salt marshes. [2]

UNIT III:

Bioactive Compounds in Mangroves: Chemical classes- Heterocyclic compounds, alkaloids, lignins & polysaccharides, lipids, flavonoids, phenolics, tannins, saponins, limonoids etc. Traditional Products, Toxicants & medicines from mangroves. [10]

Mangrove Research and Activities: Contributions of Global Institutions- UNESCO, UNDP. ITTO, ISMF Indian Institutes-NIO, MSSRF, GEER, ENVIS and SUK. [5]

UNIT IV:

Mineral Nutrition in Algae: Nutrient requirement, Essential elements, vitamins for growth of algae. Availability in sea water, Uptake, Factors affecting, Metabolic role of major elements and trace elements. [7]

Algal Research: Contributions of major Research Institutes- CSMCRI (Bhavnagar), Krishnamoorthy Institute of Algology (Mandapam ,Chennai), NIO (Goa), Department of Botany (SUK). [5]

Algal Biotechnology: Present status & future prospects. [3]

MARINE BOTANY PAPER XII: PRACTICAL COURSE II

UNIT V:

1. Estimation of pigments from marine algae-I: Chlorophylls a, b, c and d.
2. Estimation of pigments from marine algae-II: Carotenoids and Phycobilins.
3. Isolation of agar agar from seaweeds.
4. Extraction of alginic acid from seaweeds.
- 5-6. Estimation of total carbohydrates from marine algae.

UNIT VI:

1. Phytochemical analysis of seaweeds through qualitative tests.
2. Detection of phenols as bioactive compound in mangroves.
3. Determination of alkaloids from mangroves.
4. Estimation of total lipids from seaweeds.
5. Estimation of tannins from of mangroves (bark, stems and leaves).
6. Detection of bioactive compounds from mangroves using, phytochemical tests

Reference Books:

Chapman, V. J. (1976): Costal Vegetation. IInd edition Pergamon Press.
New York.

Ring, M. (1982): The Biology of Marine Plants. Edward Arnold Publishers,
London.

Gerald, E. Ecophysiology of Economic Plants in Arid and Semiarid Land.

Jackson, D. F. (1972): Algae and Man. Plenum Press.

Lobban, C. S. & Harrison, P. J. (1985): Seaweed Ecology and Physiology.
Cambridge University Press.

Lobban, C. S. And Wynne, M. J. 1981. The Biology of Seaweeds. Botanical Monographs
Volume 17. Blackwell Scientific Publications.

Sambamurthy, A. V. S. S. (2005): A Text Book of Algae. 1st. Ed.I. K. International Pvt. Ltd.
New Delhi.

Stein, J. R. (1973): Handbook of Phycological & Biochemistry.

Stewart, W. D. (1974): Algal Physiology & Biochemistry.

Tasks for Vegetation Science. 1983. Physiology and Management of Mangroves. Vol. 8, Dr. W.
Junk Publishers.

Waisel, Y. (1972): Biology of Halophytes Academic Press, London and New
York.

M. Sc. PART-II (SEMESTER III)
PAPER-XII (BO 3.4.7): PLANT BIOTECHNOLOGY
(SPECIAL PAPER II) MOLECULAR BIOTECHNOLOGY AND
GENETIC ENGINEERING

Total Lectures: 60

UNIT I:

Fundamentals of molecular biotechnology [2]

Vectors in gene cloning and their selection [6]

Molecular research procedure; Gene amplification, basic PCR, its modification, application, DNA polymorphism [7]

UNIT II:

Use of various enzymes in recombinant DNA technology [6]

Recombinant DNA and gene cloning, Techniques of restriction mapping, construction of chimeric DNA, cloning in bacteria and eukaryotes, molecular probes, southern northern and western blotting, dot and slot blots, construction and screening of genomic and cDNA libraries, chromosome walking and chromosome jumping libraries [9]

UNIT III:

Isolation, sequencing and synthesis of genes: Isolation of genes, DNA sequencing, synthesis, gene synthesis machines [10]

Plant genetic engineering: gene transfer techniques, protoplast technology [5]

UNIT IV:

Genomics: Human genome project, Nucleotide sequence databases [3]

Proteomics: Protein sequence information, composition and properties, Sequence comparison and protein databases [4]

Enzymology: IUB system, characteristics of enzyme and enzyme- substrate complex, Effect of temperature, pH, and substrate concentration on reaction rate [3]

Immunology: Immune system, Antibodies, Molecular biology of antibodies, Interferons and Vaccines [5]

PLANT BIOTECHNOLOGY PAPER XII: PRACTICAL COURSE II

UNIT V:

1. Estimation and comparison of genomic DNA by UV-vis spectrophotometry
2. DNA purification by gel electrophoresis
3. Isolation of proteins
- 4-5. Two- dimensional (2-D) paper chromatography of amino acids
- 5.

UNIT VI:

- 1-2. Genetic transformation: GUS
3. Isolation of protoplast
4. Restriction digestion of DNA
- 5-6. Determination of optimum temperature for enzyme activity

Reference Books:

- Chavala, H. S.** 1998. Biotechnology in crop improvement. International Book Distributing Co. New Delhi.
- Glick, B. R. and Pasternak, J. J.** 1994. Molecular Biotechnology- Principles and applications of recombinant DNA. ASM Press, Washington.
- Gupta, P. K.** 2000. Elements of Biotechnology. Rastogi Publisher, Meerut, India.
- Jogdand, S. N.** 1997. Gene Biotechnology, Himalaya Publishing House, Mumbai, India.
- Joshi, P.** 1998. Genetic Engineering and its applications. Agrobotanica.
- Kakralya, B. and Ahuja, I.** 2001. Transgenic Plants-Promise or Danger. Agrobios, India.
- Mitra, S.** 1996. Genetic Engineering- principles and practice. Mcmilan, India ltd.

M. Sc. PART-II (SEMESTER III)
PAPER-XII (BO 3.4.8): PLANT PROTECTION
(SPECIAL PAPER II) ANIMATE PESTS OF CROPS AND THEIR
MANAGEMENT

Total Lectures: 60

UNIT I:

Introduction: Introduction to animate pests and their examples. General characters of animate pests, Life cycles of these animate pests, Economic importance of animate pests. [4]

Non-insect pests of crops: General account of non-insect pests, damages caused by them, life cycles, and their management with respect to rats, squirrels, birds, snails and slugs, plant mites, and nematodes. [5]

Insect pests of crops: Insects as a pest of crops, Attainment of pest status, factors influencing pest populations, measurement of pest populations, Yield loss assessment, types of losses, estimation of losses in India, Exotic pests, reasons for their introduction and losses caused by them [6]

UNIT II:

Study of major insect pests: Study major insect pests of the following crops with reference to their scientific name, classification, host range, marks of identification, nature of damage, life cycle and their management.

Cereals: a) Paddy - Grass Hopper. b) Jowar - Stem Borer

Pulses: a) Tur - Pod Borers. b) Soybean - Leaf Roller

Cash crops: a) Sugar cane - Mealy Bug b) Ginger Rhizome fly

Oil seed crops: a) Ground nut -Leaf Miner b) Castor – Semi looper

Vegetables: a) Tomato - Fruit Worms b) Okra - Fruit Borers

Fruits: a) Mango stem bore b) Citrus caterpillar

Fiber plants: Cotton boll worms [15]

UNIT III:

Insect pests of ornamental plants: Study of following pests with reference to their scientific name, classification, host range, marks of identification, nature of damage, life cycle and their management: a) Scale Insects b) white fly c) Red Spider mite. [4]

Polyphagous insect pests: Study of following polyphagous insect pests with reference to their scientific name, classification, host range, marks of identification, nature of damage, life cycle and their management. a) Aphids b) termites c) *Heliocoverpa* sp. d) Cut worms [7]

Stored grain insect pests: Study of following stored grain insect pests with reference to their scientific name, classification, host range, marks of identification, nature of damage, life cycle and their management.

a) Rice moth b) Khapra beetle c) Red flour beetle d) Lesser grain borer [5]

UNIT IV:

Pest management: Overview of methods of pest management viz. Legal, Mechanical, Physical, Chemical and Cultural Methods of pest control.

Chemical Control of Pests: Pesticide toxicity, Modes of action-Nerve poisons (Narcotics, Axonic and synaptic poisons), Muscle poisons and Physical toxicants; Factors influencing effectiveness of pesticides, pestiticide resistance; Resurgence of pests; Effects on non-target organisms, Pesticide residue. [6]

Biological Control of Pests: -Concept, Some successful examples of biological control, Agents of biological control; Mass culture and release of parasitoids and predators; Environmental manipulation; Synergism among biological control. [4]

Semiochemicals Control of Pests: Introduction, Concept and Classification of semiochemicals; Pheromones and Allelochemicals concept and uses of these to control of pests. [2]

Control of Pests by Hormonal Imbalance: Control of Pest by insect growth regulators-ecdysoids, juvenoids, anti-hormones, chitin inhibitors, miscellaneous insect growth regulators, sources of insect hormone mimics. [3]

PLANT PROTECTION XII: PRACTICAL COURSE II

UNIT V: Study major insect pests of the following crops with reference to their scientific name, classification, host range, marks of identification, nature of damage, life cycle and their management.

- 1. Cereals:** a) Paddy - Grass Hopper. b) Jowar - Stem Borer
- 2. Pulses:** a) Tur - Pod Borers. b) Soybean - Leaf Roller
- 3. Cash crops:** a) Sugar cane - Mealy Bug b) Ginger Rhizome fly
- 4. Oil seed crops:** a) Ground nut -Leaf Miner b) Castor – Semi looper
- 5. Vegetables:** a) Tomato - Fruit Worms b) Okra - Fruit Borers
- 6. Fruits:** a) Mango stem bore b) Citrus caterpillar

UNIT VI: Study of following pests with reference to their scientific name, classification, host range, marks of identification, nature of damage, life cycle and their management:

- 1. Fiber plants:** Cotton boll worm
- 2. Pests of ornamental plants:** a) Scale Insects b) white fly c) Red Spider mite.
- 3. Polyphagus Pests:** a) Aphids b) termites c) *Helicoverpa* sp. d) Cut worms
- 4. and 5 Stored grain insect pests:** a) Rice moth b) Khapra beetle c) Red flour beetle d) Lesser grain borer
- 6. Biocontrol agents:** Study of some common bio control agents.

References

- Agrios, G. N.** (1997). Plant Pathology, 4th Edn. Academic press, San Diego
- Aneja K. R.:** Experiments in Microbiology, Plant Pathology and Tissue Culture. Wishwa publishers
- Aneja, K. R** (2005). Experiments in Microbiology and Plant Pathology and biotechnology. New Age International (P) Ltd. Publishers, New Delhi.
- Atwal, A. S.** (1936) Agricultural Pest of India and South East Asia. Kalyani Publishers, New Delhi
- Baruah H. K.,** P Brain and A. Baruah, (1984). Textbook of plant pathology. Oxford and IBH Publ. Co., New Delhi.
- Bilgrami K. S. and Dube H. C.** (1990). Text book of Modern pathology. Vikas Publishing House Pvt. Ltd. New Delhi.
- Chandrashekharan S. N. and S. V. Parthasarthy** (1965). Cytogenetics and Plant Breeding. P. Varadachary and Co. Madras.
- Chatterjee P. B.** (1997). Plant Protection Techniques. Bharti Bhawan. Patana
- Chatterjee, P. B.** (1997) Plant protection techniques. Bharati Bhawan Publishers and Distributors Patna.
- Chattopadhyaya, S. P.** (1987) Principles and Procedures of Plant Protection. Oxford and IBH, New Delhi.
- Dhaliwal, G. S. and Arora Ramesh** (1994) Trends in Agricultural Pest Management. Commonwealth Publishers, New Delhi.
- Dickinson M.** (2008). Molecular Plant Pathology. BIOS Scientific Publishers, London and New York.
- Dickison, M. J. and J. Beynon** (2000). Annual Plant Reviews, Volume 4-Molecular plant Pathology. Sheffield Academic press, Sheffield.
- Diskson J. C.** (1964) Diseases of Field crop. McGraw –Hill, New Delhi.
- Gerhardson, B** (2002). Biological substitutes for pesticides. *Trends in biotechnology* **20**:338-343. ICAE, Publication.: Crop Diseases Calendar
- Jha, L. K.** (1987) Applied Agricultural Entomology. New Central Book Agency, Calcutta.
- Jones D. G.** (1987) Plant pathology – Principles and practices. Open University Press, Stratford.
- Mehrotra R. S. and Ashok Aggarwal** (2005) Plant Pathology. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Mehrotra, R. S.** (1980). Plant pathology. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Metcalf, C. L. and Flint, W. P.** (1983) Destructive and Useful Insects. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Nagarajan S.** (1999) Plant Diseases and Epidemiology. Oxford and IBH, New Delhi.
- Nagarajan, S. and K. Mualidharan** (1995) Dynamics of Plant Diseases. Allied Publishers, New Delhi .
- Pathak V. N.** (1980) Diseases of Fruit crops. Oxford and IBH, New Delhi.
- Pedigo, L. P.** (1996) Entomology and pest Management. Prentice-Hall Pub. Englewood cliffs NJ
- Punja, Z. K.** (2001). Genetic engineering of plants to enhance resistance to fungal pathogens-a review of progress and future prospects. *Canadian Journal of plant pathology* **23**: 216-235.
- Ramakrishnan T. S.** (1974) Diseases of Millets. ICAR, New Delhi.

- Rangaswami**, G. (1975) Diseases of crop plants in India. Prentice-Hall Pub, New Delhi.
- Rao** V. S.(1987) Principles of Weed Science. Oxford and IBH, New Delhi.
- Rashid** S. N. and M. M. A. Khan : Dictionary of Remote Sensing. Manak Publication Pvt. Ltd., New Delhi.
- Roberts** D. A. and Bothroyd C. W. (1995) Fundamental Plant Pathology. W. H. Freeman & Co
- Rommens**, C. M. and G. M. Kishore (2000). Exploiting the full potential of disease resistance genes for agricultural use. *Current Opinions in Biotechnology* **11**:120-125.
- Saha** L. R. (1990) Hand Book of Plant Protection. Kalyani Publ. New Delhi.
- Saha**, L. R. and Dhaliwal G. S. (2006) Handbook of Plant Protection. Kalyani Publ. New Delhi.
- Sambamurty**, A. V. S. S. (2008). Molecular biology. Narosa Publishing House, New Delhi. ISBN 978-81-7319-837-3.
- Schillberg**, S., S. Zimmermann, M. Y. Zhang and R. Fisher (2001). Antibody-based resistance to plant pathogens. *Transgenic research*.**10**:1-12.
- Shrivastava**, V. P. (1988). A Textbook of Applied Entomology. Kalyani Publ. New Delhi
- Sill** Webster H. (1983). Plant Protection. Iowa State Univ.Press
- Singh** Tribhuwan and K. Agarwal (2001). Seed Technology and Seed Pathology, Pointer Publishers, Jaipur-302003 (Raj), India. ISBN 81-7132-284 -0
- Singh**, R. S. (1998) Plant Diseases. Oxford & IBH Publ.
- Singh**, R. S., U. S. Singh, W. M. Hess and D. J. Weber (1988). Experimental and conceptual plant pathology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- Stuiver**, M. H. and J. H. H. V.Custers (2001). Engineering disease resistance in plants. *Nature* **411**: 865-868.
- Suryanaryana**, D. (1974) Seed pathology. Vikas New Delhi
- Tepfer**, M. (2002). Risk assessment of Virus-resistant transgenic plants. *Annual Review of Phytopathology***40**:467-491.
- Journals** : 1. Crop Protection 2. Geobios 3. Journal of Entomological Society of India.

M. Sc. PART-II (SEMESTER III)
PAPER-XII (BO 3.4.9): PLANT DIVERSITY
(SPECIAL PAPER II) CONSERVATION OF BIODIVERSITY

Total Lectures: 60

UNIT I:

Environmental accounting: Origin and development, importance of natural resources and environment, merits and demerits of environmental accounting, environmental accounting with reference to Indian context. [8]

Environmental impact assessment (EIA): Introduction, definition, approaches to EIA, Environmental impact assessment as inter disciplinary process, importance of environmental impact assessment [7]

UNIT II:

Conservation of biodiversity: The need for conservation of biodiversity, conservation strategies, bio-safety and bio-ethics, biodiversity conservation in India, national policies and goals, current efforts and action programs, peoples' involvement in biodiversity conservation. [8]

Ex-situ conservation: Concept, polyhouse, greenhouse, botanical gardens, seed banks, germplasm, gene banks, advantages and disadvantages, justification of ex-situ conservation. [7]

UNIT III:

In-situ conservation: Concept, advantages and disadvantages, role of national parks, sanctuaries, biosphere reserves, conservation of habitats, restoration of degraded habitats. [6]

Biodiversity legislations and conventions:

a) Legislations

Indian Forest act, 1927
Wild life protection act, 1972
Forest Conservation act, 1980
Biological diversity act, 2002
Biological diversity rules, 2004

b) Conventions

Ramsar convention on wetland (1971)
Paris convention on natural heritage (1972)
Washington convention on trade of flora and fauna (1973)
UNCED (1992)
Kyoto protocol (1997)
Earth summit, Montreal(2005)
Earth summit, Copenhagen (2009) [9]

UNIT IV:

Role of Government and Non-Government Organizations (NGOs) in conservation of biodiversity: Concept, working and evaluation of NGOs viz. WWF, IUCN, UNCED, BNHS, BSI, ZSI, local NGOs involved in biodiversity conservation, Role of Green organizations viz. TERI, CES, MOEF. Role of taxonomy and taxonomists in conservation of biodiversity. [15]

PLANT DIVERSITY PAPER XII: PRACTICAL PAPER II

UNIT V:

1. Study of exotic plants in India.
- 2-3. Study of wild edible fruits and medicinal plants.
4. Study of wild ornamental plants.
5. Study of critically endangered plant species.
6. Study of vulnerable plant species.

UNIT VI:

1. Study of monotypic endemic genera of Western Ghat.
2. To discover and describe an inventory of local plant species diversity.
3. Assessment of the economic value of plant biodiversity (as food, fodder, medicine or timber) from the near by market.
4. Visit to a NGO working in the field of biodiversity and writing a proposal for an NGO.
- 5-6. Visit to local centres *ex-situ* and *in-situ* conservation programme and report writing.

Reference Books:

- Pramanik** A K 2002 Environmental Accounting and Reporting Deep and Deep Publications
- Arora** V. 2002 The Biological Diversity Act; Natraj Publishers, Dehradun
- Santra** S C 1994 Ecology: Basic and Applied; M D Publications Pvt Ltd
- Asthana** D. K. and **Asthana** M. 2001 Environment: Problems & Solutions; S. Chand Limited
- Groom**, M. J., Meffe G. K. And Carroll C. R. 2005. Principle of conservation Biology. Sinaur Associates, Inc Sunderlands, Massachusetts, USA.
- Primack**, R. B. 2010. Essentials of Conservation Biology. Sinaur Associates, Inc Sunderlands, Massachusetts, USA.
- Briggs David** 2009. Plant microevolution and Conservation in Human-influenced Ecosystems. Cambridge University Press.
- Leadlay**, E. And Jury, S. 2006. Taxonomy and plant conservation. Cambridge University Press.

M.Sc. II PART-II (SEMESTER IV)

PAPER-XIII (B O 4.1): PLANT PHYSIOLOGY AND METABOLISM

Total Lectures: 60

UNIT I:

Membrane transport and translocation of water and solutes: Mechanism of xylem and phloem transport, phloem loading and unloading, membrane transport of proteins. [5]

Photosynthesis: Brief outline of evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, photo oxidation of water, mechanism of electron and proton transport, RUBISCO, Sub classification of C₄ plants, ecological significance and modification of CAM. [10]

UNIT II:

Respiration: Overview of plant respiration, Anaerobic respiration, Modern concept of electron transport and ATP synthesis. Inhibitors of respiration. Gluconeogenesis. [8]

Lipid Metabolism: Synthesis of triglycerides, fatty acids, membrane lipids, structural lipids and their catabolism, Glyoxylate cycle. Role of Mitochondria. [7]

UNIT III:

Sulphur Metabolism: Sulphate Uptake, Transport, Reduction and Assimilation. [3]

Physiology of Flowering: Photoperiodism and its significance, Floral Induction and development- genetic and molecular analysis, Role of Vernalization. [5]

Stress Physiology: A brief idea of plant responses to water deficit, salinity and oxidative stress. [7]

UNIT IV:

Signal Transduction: Overview, Receptors and G proteins, Phospholipid signalling, Role of cyclic nucleotides, Calcium-Calmodulin cascade, Protein Kinases and Phosphatases, Specific signalling mechanisms (Two component regulatory system in bacteria). [9]

Phytohormones: General mode of action of phytohormones. Biosynthesis and mechanism of action of auxins [6]

PLANT PHYSIOLOGY AND METABOLISM

PAPER XIII: PRACTICAL COURSE

UNIT V:

1. Determination of lipid peroxidation in plants under stress.
- 2-3. Amino acids analysis of phloem sap with paper chromatography.
4. Determination of Chlorophyll a / b ratio of C₃ and C₄ plants.
5. Determination of rate of respiration in germinating seeds under aerobic and anaerobic conditions.
6. Study of enzyme lipase.

UNIT VI:

- 1-2. Effect of red and far red light on seed germination.
3. Determination of sulphate from crop plants.
4. Measurement of RWC in plants under stress.
5. Study of enzyme Superoxide dismutase in plants.
6. Estimation of proline from stress and non-stress plant.

REFERENCE BOOKS

Bidwell, R. C. S. (1979): Plant Physiology. Macmillan

Bonner, J. and Varner, J.E. (1972): Plant Biochemistry. IBH.

Buchnan, B.B., Gruissem, W. And Jones, R.L. (2000) Biochemistry and Molecular Biology of Plants. Wiley-Blackwell

Edwards G. and Walker D., eds. (1983). C₃, C₄: mechanisms, and cellular and environmental regulation, of photosynthesis. Oxford: Blackwell Scientific Publications.

Govindjee, H. (ed.) (1982): Photosynthesis, Vol. 1 and Vol. 2. Academic Press, N.Y. (Vol. 1); 0-12- 294302-2 (Vol. 2))

Hopkins, W. C. (1995): Introduction to Plant Physiology. Wiley, New York.

Krishnamurthy, H.N. (1992): Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.

Marschner, H. W. (1986): Mineral nutrition of Higher Plants. First Edition, Academic Press, Elsevier Science Ltd.

Marschner, H. W. (2003): Mineral nutrition of Higher Plants. Second Edition, Academic Press, Elsevier Science Ltd.

Moore, T.C. (1974): Research experience in Plant Physiology, A Laboratory manual. Springer-Verlag, Berlin.

Mukherjee, S.P. and Ghosh A.N. (1996): Plant Physiology. New Central Book Agency (P) Limited Tata McGraw Hill.

Noggle, G.R. and Fritz, G. J. (1976): Introductory Plant Physiology. Prentice- Hall, Inc., Englewood Cliffs, NJ.

Pessaraki, M. (Ed.). (2001). Handbook of Plant and Crop Physiology, 2nd Edition, Revised and Expanded. Marcel Dekker, Inc., New York

Pessaraki, M. (Ed.). (2005). Handbook of Photosynthesis, 2nd Edition, CRC Press, Taylor & Francis Publishing Company, Florida

Randhir Singh and Sawhney S. K. (1988): Advances in frontier Areas of Plant Biochemistry. Prentice Hall of India

Sadasivam S. and Manickam A. (1996): Biochemical methods. New Age International.

Salisbury, F. B. and Ross, C.W.(1992): Plant Physiology IV ed. Cengage Learning

Smith, H. (1975): Phytochrome and Photomorphogenesis. McGraw-Hill Inc.,US

Taiz, L. and Zeiger, F. (1998, 2002): The Plant Physiology. Second Edition, Third Edition, Sunderland: Sinauer Associates.

Wilkins, M. B. (1976): Physiology of Plant Growth and Development. McGraw-Hill Publishing Company Limited

Journals

Annual Review of Plant Physiology and Molecular Biology.

Annual Review of Plant Physiology

Indian Journal of Plant Physiology.

Journal of Experimental Botany.

Physiologia Plantarum Sweden.

Plant Physiology (Bethesda, USA).

Plant Cell.

M. Sc. PART-II (SEMESTER IV)

PAPER-XIV (B.O.4.2): BIODIVERSITY, CONSERVATION AND UTILIZATION

Total Lectures: 60

UNIT-I

BIOLOGICAL DIVERSITY: Mega diversity countries, magnitude of biodiversity, direct, indirect and ethical values of biodiversity, loss of biodiversity, reasons for loss of biodiversity, Taxonomic initiatives, Systematic agenda 2020. [15]

UNIT-II

ENDEMISM: Definition, types of endemism, RED list categories of IUCN, Hot spots and Hottest hotspots, Keystone and Flagship species, Biodiversity of India, Hotspots of plant diversity in India, Plant endemism in India with special emphasis on Western Ghats. [15]

UNIT-III

CONSERVATION: Introduction, principles, *In-situ* conservation, *Ex-situ* conservation, restoration programs, World organization for conservation, efforts by Indian government for conservation [15]

UNIT-IV

WILD PLANT RESOURCES AND THEIR UTILIZATION: Wild Plants of ornamental potential, wild relatives of cultivated plants, wild edible plants and their nutritive value, under exploited medicinal plants, plants of commercial importance, energy plants, petrocrops, Plants suitable in phyto-remediation [15]

PLANT BIODIVERSITY AND CONSERVATION

PAPER XIV: PRACTICAL COURSE

Unit V:

1. Geographical location of hotspots and hottest hot-spots of the world
2. Endemic plants of Western Ghats
3. RED list categories of IUCN and local examples for each category
4. Wild plants of Ornamental potential (minimum 15 plant species)
- 5-6. Wild relatives of cultivated plants (*Abelmoschus*, *Cucumis*, *Momordica*, *Vigna*, Rice, *Sorghum*, Sugarcane etc.)

Unit VI:

- 1-2. Wild edible plants: microchemical test to detect sugar, starch, protein and lipids
3. Underexploited medicinal plants
4. Plants of commercial importance: detection of alkaloids (Solanaceae members)
5. Energy plants: determination of lipids (Castor, *Jatropha* and *Pongamia* seeds)
6. Plants useful in Phytoremediation

Books and References:

- Leadlay, E. and Jury, S. (eds.).** 2006. Taxonomy and Plant Conservation. Cambridge University Press.
- Heywood, V. H. and Watson, R. T. (eds.).** 1995. Global Biodiversity Assessment. UNEP, UK, Cambridge University Press.
- UNEP.** 1992. Convention on Biological Diversity (CBD): Text and Annexes. Geneva, Switzerland: CBD Interim Secretariat.
- UNEP.** 2002a. Global Taxonomy Initiative (GTI). Decision VI/8. UNEP/CBD/COP/6/20 Montreal, Canada: CBD Secretariat.
- UNEP.** 2002b. Global strategy for Plant Conservation. Decision VI/9. UNEP/CBD/COP /6/20 Montreal, Canada: CBD Secretariat.
- WEHAB Working Group.** 2002. A Framework for Action on Biodiversity and Ecosystem Management.
- Briggs, D.** 2009. Plant Microevolution and Conservation in Human-influenced Ecosystems. Cambridge University press.
- Groom M. J., Meffe, G. K. and C. R. Carroll.** 1997. Principles of Conservation biology.(3rd ed.) Sinauer associates, Inc. publishers Sunderland, Massachusetts, USA.
- Primack R. B.** 2010. Essentials of Conservation Biology. (5th ed.). Sinauer associates, Inc. publishers Sunderland, Massachusetts, USA.

M.Sc. PART- II (SEMESTER IV)
PAPER-XV (BO 4.3.1): PLANT PHYSIOLOGY
(SPECIAL PAPER III) STRESS PHYSIOLOGY OF PLANTS

Total Lectures: 60

UNIT I:

Water stress: Causes of water stress: Arid and Semiarid regions, Drought effect on physiological processes in plants, Mechanism of stomatal action, various mechanisms of drought resistance in plants, Antitranspirants, Drought hardening, Transgenic approach. [8]

Flooding stress: Nature of waterlogging stress. Effect of flooding stress on physiological processes in plants. Wetland and non wetland species. Mechanism of waterlogging tolerance. [7]

UNIT II:

Salt stress: Definition of saline soil, Causes of soil Salinization. A brief outline of Salt affected soils in India, Physiological responses of plants to salinity stress, Halophytes and glycophytes mechanism of salinity tolerance in higher plants, Genetic engineering for salt tolerance. [9]

Ionic stress: Effect of ion toxicity (iron, zinc), heavy metals toxicity and aluminum toxicity in plants, Phytoremediation, Mechanism of aluminium tolerance, Transgenic approaches. [6]

UNIT III:

Thermal stresses: Effect of high and low temperatures on plant metabolism, Mechanisms of high and low temperatures tolerance, Cold hardening, Role of HSP. [5]

Radiation stress: Influence of high light intensity on photosynthesis, Photoprotection mechanisms, Effect of UV radiations on plants, Mechanism of UV tolerance. [5]

Oxidative stress: Generation of reactive oxygen species, Effect of ROS on metabolism, ROX detoxification mechanisms in plants, Transgenic approaches. [5]

UNIT IV:

Gaseous stress: Effect of elevated CO₂ concentration on plant metabolism, Effect of air pollutant SO₂ and O₃ on plants. [6]

Biotic stress: Effect of fungal infection on plant metabolism, Biochemical mechanism of disease resistance, Allelopathy [9]

PLANT PHYSIOLOGY PAPER XV: PRACTICAL COURSE III

UNIT V:

1. Measurement of osmotic potential of controlled and stressed tissue.
2. Determination of chlorophyll stability index.
- 3-4. Estimation of chlorides in leaves of halophytes and glycophytes.
5. Estimation of free proline in plants under stress.
6. Study of effect of fungal infection on polyphenol oxidase activity.

UNIT VI:

1. Study of phenolics in scales of onion varieties differing in disease resistance.
- 2-3. Study of free radicals scavenging enzymes, catalase and super oxide dismutase in healthy and infected plants.
4. Estimation of carotenoids in control and stressed plants
- 5-6. Study of seed germination under stress condition.

Reference Books:-

Buchnan, B.B., Gruissem, W. And Jones, R.L. (2000) Biochemistry and Molecular Biology of Plants. Wiley-Blackwell

Cherry, J. H. (ed.) (1989) Environmental Stress in Plants: Biochemical and Physiological Mechanisms Associated with Environmental Stress Tolerance in Plants (NATO ASI Series G, vol. 19). Springer, Berlin.

Fitter, A.H. and R.K.M. Hay, (1987) Environmental Physiology of Plants. Academic Press, San Diego, CA, 2nd. ed.

Hale, M.G. and Orcutt, D.M. (1987) The Physiology of plants under stress. John Wiley and Sons, New York.

Kozlowski, T.T. (1984) Flooding and Plant Growth. Ed. T.T. Kozlowski. Academic Press, Orlando, FL

Levitt, J. (1980) Responses of plants to environmental stresses: Vol.II, Water, Radiation, Salt and other. Academic Press, New York

Mansfield, T.A. (1976) Effects of Air Pollutants on Plants. CUP Archive

Mehrotra, R. S. (1980): Plant Pathology. Tata McGraw-Hill

Paleg, L.G. and Aspinal, D. (1982) The Physiology and Biochemistry of Drought resistant in Plants. Academic Press, Sydney.

Poljakoff-Mayber, A. and Gale, J. (eds.). (1975) Plants in saline environments. Springer Verlag, New York, USA

Rice, E. L. (1974) Allelopathy, Academic Press, New York, San Francisco, London

Srivastava Y.N. (2009) Environmental Pollution APH Publishing Corporation, New Delhi

Turner, N. C., and Kramer, P. J. (1980) Adaptation of Plants to Water and High Temperature Stress. Wiley, New York

Taiz, L. and Zeiger, F. (1998, 2002, 2008): The Plant Physiology. (Second Edition 1998, Third Edition 2002, Fourth Edition 2008) Sunderland: Sinauer Associates.

Journals

Allelopathy Journal

Annual Review of Plant Physiology and Molecular Biology.

Annual Review of Plant Physiology

Indian Journal of Plant Physiology.

Journal of Experimental Botany.

Physiologia Plantarum, Sweden.

Plant Physiology, Bethesda, USA

Plant Cell

M. Sc. PART-II (SEMESTER IV)
PAPER-XV (BO 4.3.2): MYCOLOGY & PLANT PATHOLOGY
(SPECIAL PAPER III) INDUSTRIAL MYCOLOGY

Total Lectures: 60

UNIT I:

Role of fungi in industry: Scope and their utility. [5]
Commercial fungal strains: Selection, improvement, development and their maintenance. [5]

Fermentation:

Industrial alcohol production through fermentation
Industrial production of organic acids: citric, fumaric, itaconic and kojic acid. [5]

UNIT II:

Industrial production of enzymes: amylases, proteases, pectinases and invertases. [7]
Industrial production of vitamins: vitamin B₁₂, riboflavin, vitamin A. [6]
Industrial production of gibberellins [2]

UNIT III:

Industrial production of antibiotics [6]
Production of ergot alkaloids. [4]
Economics of fermentation. [5]

UNIT IV:

Edible fungi, their nutritional value and role in cottage industry. Large and small scale cultivation technique of *Agaricus bisporus*, *Pleurotus* spp., *Volvariella volavacea* and their preservation, diseases and their control, cost benefit analysis. [15]

MYCOLOGY & PLANT PATHOLOGY PAPER XV: PRACTICAL COURSE III

UNIT V:

1. Maintenance of fungal strains using different methods.
2. Production of industrial alcohol by fermentation technique.
3. Detection of citric acid from mycelial biomass using circular paper chromatography.
4. Detection of antibiotics from mycelial biomass.
- 5 & 6. Production of ergot alkaloid by using fungal elicitors.

UNIT VI:

- 1 & 2. Preparation of spawn: Grain, Perlite and manure spawn.
- 3 & 4. Cultivation of mushroom.
- 5 & 6. Study of some enzymes (amylases, proteases, pectinases and invertases) of fungal origin.

Reference Books:

Casida, L. E. Jr. (1964). Industrial Microbiology. John Wiley and Sons, USA

Whipps, J. M. and Lumsden, R. D. (1989). Biotechnology of fungi for improving plant growth. Press Syndicate of the University of Cambridge, UK

Turner (1971). Fungal metabolism. Academic Press, USA

Atal (1978). Indian Mushroom Science-I. Indo American Literature House

Kannaiyan (1980). A hand book of edible mushrooms. Today's and Tomorrow's. Publ.

Purkhyastt (1976). Indian edible mushrooms. Firma KLM, 1976 Cornell University

Smith, J. F. and Barry, D. R. The filamentous fungi Vol.I Industrial Mycology Vol.II and III. Edward Arnold, London.

Dodge, C.W. (1935). Industrial Mycology.

Prescott, S. G. and Dunn, C. D. (1959). Industrial Microbiology. AVI Pub.n Com. Westport, CT

Christensen, C. M. (1975): Mould, Mushrooms and Mycotoxins. University of Minnesota press, Minneapolis

Rose, A. H. (1961). Industrial Microbiology. Butterworths, London

Singer, R. (1961). Mushrooms and Truffles cultivation and utilization. Leonard Hill, Ltd.,

Rhodes, A. and Fletcher, D. L (1966). Principles of industrial microbiology. Pergamon Press, Oxford, UK

Gray, W. D. (1970). The use of fungi as food and food processing. Cleveland, Oh: CRC Press, USA

Lodder, J. (1970). The Yeast. North- Holland, Amsterdam

Chang, S. T. and Hays, W. A. (1978). The biology and cultivation of edible mushrooms. Academic Press, New York.

Aneja, K. R. (1993). Experiments in Microbiology, Plant Pathology and Tissue Culture.

Onions, A. H. S. D. Allsopp and Eggins, H. O. W. (1981). Smith's Introduction to Industrial Mycology. New Age International Publishers

Barger, G. (1931). Ergot and Ergotism. Edward Arnold

Fletcher, J. T., White, P. F. and Gaze, R. H. (1989). Mushrooms: Pest and Disease Control. Intercept, Ltd., VCH Publishers, Suite 909, 220 East 23rd Street, New York,

M.Sc. PART-II SEMESTER IV

PAPER-XV (BO 4.3.3): CYTOGENETICS AND PLANT BREEDING

(SPECIAL PAPER- III) MOLECULAR GENETICS

Total Lectures: 60

UNIT I:

Microbial Genetics: Genetic studies in microorganisms with special reference to *Escherichia coli* and *Agrobacterium* spp. Genetic exchange in bacteria- an overview (mutants, conjugation, transduction and transformation) [15]

UNIT II:

The Genetics of Viruses: The structure and life cycle of bacterial virus, Mapping the bacteriophage genome (Phage phenotypes, genetic recombination in phage, fine structure and deletion mapping), T₄ genetic map, bacteriophage X 174. Molecular analysis of DNA, RNA and proteins using blotting techniques and micro arrays; molecular markers (third and fourth generation) and their uses [15]

UNIT III:

PCR and DNA sequencing: PCR and its types. Classical methods for DNA sequencing, Automatic DNA sequencers. Restriction maps and molecular genetic maps [15]

UNIT IV: Bioinformatics, Genomics and Proteomics: Bioinformatics tools for analyzing genomic information; Biological databases, Comparative genomics- Ancient duplications and Palaeopolyploidy, Phylogenetic analysis. Genomes of higher plants- *Arabidopsis*, Rice, Soybean and Grapevine [15]

CYTOGENETICS AND PLANT BREEDING PAPER XV: PRACTICAL COURSE III

UNIT V:

1. Study of bacterial conjugation
2. Study of bacterial transduction
3. Study of transformation in *E. coli*
4. Induction of mutation and study of mutants in *E. coli*
- 5-6. Study of restriction digestion analysis by gel electrophoresis

UNIT VI:

1. Demonstration of southern blotting
2. DNA amplification using RAPD/ ISSR markers
3. Phylogenetic analysis
4. Proteomics
- 5-6. GUS expression in plants

Reference Books:

Twyman R. M. 1998. Advanced molecular Biology. Viva Books Pvt. Ltd. New Delhi.

Wolfe S. L. 1993. Molecular and cellular biology. Wadwith Publishing Co. California USA.

- Lewin, B.** 2008, Genes IX Oxford University Press, New York.
- Brown T. A.** 1998. Genomes. John Wiley and sons Singapore.
- Alberts B. et al** 1994. Molecular biology of the cell 3rd Edition Garland Publishing, New York.
- Singh B. D.** 1990. Fundamentals of Genetics. Kalyani Publishers Ludhiana.
- Latchman D. S.** 1990. Gene regulation an eukaryotic perspective. Unwin Hyman Publication London.
- Klug W. S. and Cummings M. R.** 1983. Concepts of Genetics. Charles E. Merrill Publishing Company London.
- Jain H. K.** 1999. Genetics Principles, Concepts and Implications. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Gupta P. K.** 1985. Genetics Rastogi Publications Meerut.
- Griffith A. J. F. Miller J. H., Suzuki D. T., Lewontin R. C. and W. M. Gelbart** 1996. An introduction to Genetics Analysis. 6th Edition W. H. Freeman New York.
- Strickberger M. W.** 1996 Genetics 3rd Edition MacMillan Publishing Co. New Delhi.

Journals:

1. Annual review of Microbiology
2. Journal of Cytology and Genetics
3. Cytologia
4. Caryologia
5. Indian Journal of Experimental Biology
6. Journal of Experimental Botany
7. Trends in Biotechnology (Elsevier)

M.Sc. II PART- II (SEMESTER IV)

PAPER-XV (BO 4. 3.4): ENERGY, ECOLOGY AND ENVIRONMENT

(SPECIAL PAPER III) EXPERIMENTAL ECOLOGY AND ENERGY STUDIES

Total Lectures: 60

UNIT I:

Ecological Methods: Autecology and synecology. Fresh water and marine ecology [6]

Methods of community study: Minimal area curve, Quadrats, Transects, Grid, Use of GPS in Mapping. [4]

Use of indices in ecological study, Measurement of primary productivity in terrestrial and aquatic ecosystems. [5]

UNIT II:

Systems Ecology: Introduction and basic elements. [3]

Field survey, rapid surveys, Remote sensing, Use of satellite imageries, Applications of remote sensing technique. [5]

Ecosystem Modelling: conceptual model, working model, auxiliary variables and foresters diagram. [4]

Methods to study ecology of genetic erosion. [3]

UNIT III:

Energy Sources: Biomass as a source of energy, Composition of biomass (cellulose, hemicelluloses, lignin), Terrestrial biomass, aquatic biomass. [5]

Biomass conversion: Non-biological process, pyrolysis, gasification etc.

Biological process, enzymatic digestion, anaerobic and aerobic digestion. [5]

Bioenergy: Energy plantation, social forestry, silviculture energy farms, petroleum plants, hydrocarbon from higher plants (*Hevea*, *Euphorbia*), algal hydrocarbons

Biogas Technology and Hydrogen as a fuel. [5]

UNIT IV:

Energy from Waste: Biogas production, Biomass sources, Biomass to electricity, Biovillage and Biomass energy. [5]

Vermicompost, Eco Cook stoves, Rain harvesting, Solar power. [3]

Conservation of Energy: Energy efficiency, average energy consumption, Sources of energy conservation: solar, wind, geothermal, wave, hydroelectric and biomass energy. [7]

ECOLOGY PAPER XV: PRACTICAL COURSE III

UNIT V:

1. Survey and mapping of area by GPS.
2. Seed germination under various treatments for tree species.
3. Study of seed output and reproductive capacity.
4. Study of petrocrops and energy plants.
5. Determination of calorific value of wood.
6. Study of effect of natural light intensity on primary productivity of an aquatic ecosystem.

UNIT VI:

1. Setting up of an ecological model.
2. Use of ecological model in the field study.
3. Determination of Leaf Area Index (LAI).
4. Induction of rooting.
5. Statistical analysis of ecological data.
6. Study of population growth curve.

Reference Books:

- Agarwal S. K.** (1992): Fundamentals of Ecology. New Delhi: Ashish Publishing House.
- Bradbury I. K.** (1990): The Biosphere. Published by John Wiley & Sons, Chichester.
- Das S. M.** (1989): Handbook of Limnology and water pollution with practical Methodology. Published by South Asian Publishers, New Delhi.
- Etherington J.R.** (1975): Environment and plant ecology : aims and development. Publisher Wiley.
- Freedman H. I.** (1980): Deterministic mathematical models in population ecology. Marcel Dekker Inc., New York.
- Greig Smith P.** (1983): Quantitative Plant Ecology. *Publisher:* WILEYBLACKWELL
- Grims J. P. et al** (1988): Comparative Plant Ecology. Colvend, Dalbeattie, Kirkcudrightshire [Scotland] : Castlepoint Press.
- Hashimoto Y et al** (1990): Measurement techniques in plant sciences. San Diego, Calif. : Academic Press
- Kershaw K. A.** (1964): Quantitative and dynamic ecology. Publisher: Edward Arnold
- Kormondy E. J.** (1996): Concept of ecology. Publisher: Benjamin Cummings.
- Krebs C. J.** (1978): Ecology. Harper & Row., New York.
- Lieth H. F. et al** (1973): Patterns of primary production in the biosphere. Kluwer Academic Publishers-Plenum Publishers.

Misra K. C. (1989): Manual of plant ecology. Oxford and IBH Publishing Co., New Delhi.

Misra R. and Das R. R. (1971): Proceedings of the school of plant ecology. Publisher: Calcutta Oxford & IBH Pub. Co.

Odum E. P. (1971): Ecology. Publisher: Saunders

Odum E. P. (3rd ed. 1996) : Fundamentals of Ecology. Natraj Publishers, Dehra Dun.

Pandeya S. C. *et al* (1963) : Research methods in plant ecology. Asia Publishing House.

Watt K. E. F. (1973) : Principles of Environment Sciences. Published by McGraw-Hill.

M. Sc. PART II (SEMESTER IV)
PAPER-XV (BO 4.3.5): ANGIOSPERM TAXONOMY
(SPECIAL PAPER III) ANGIOSPERM TAXONOMY FLORISTICS AND
BIOSYSTEMATICS

Total Lectures: 60

UNIT I:

Floristics: Need and significance of floristic studies, methodology, analysis and data presentation. [3]

Taxonomic literature: General taxonomic indexes, world floras and manuals, monographs and revisions, bibliographies, catalogues, review serials, periodicals, glossaries, dictionaries, cultivated and economic plants, maps and cartography, biographical references, dates of publication, location of type specimens, dictionaries and addresses, colour charts, outstanding botanical libraries. [7]

Botanical keys: Diagnostic, synoptic and artificial keys-Single access (sequential)-bracketed and indented keys and multi-access keys, edge-punched and body-punched (polyclave) keys, tabular and lateral keys; computerized keys, their merits and demerits. [5]

UNIT: II

History of botanical exploration in India: Beginning of botany in India, contributions made in earlier phase by Garcia d'Orta, C. Acosta, Van Rheede, John Burman, John Koenig, Robert Kyd, Buchanan, Roxburgh, N. Wallich, William Griffith, Robert Wight, Thomas Thomson, J. D. Hooker, Collet, Brandis, T. Cooke, Duthie, Fyson, Gamble, Haines, Parkinson, Prain, Santapau, and recent works with special emphasis on Maharashtra. Botanical Survey of India (BSI). [10]

Biosystematics: Aims, concepts of species, steps in biosystematic study, biosystematic categories- ecotype, ecospecies, cenospecies, comparium, methods in biosystematic studies, ecotypic variations and taxonomy, scope and limitations. [5]

UNIT: III

Origin of agriculture and rise of food crops: Introduction, food plants, origin and spread of *Homo sapiens*, centres of plant domestication of major crops, crop dispersal and distribution.

[5]

Plant domestication: Introduction, Evolution of farming, Plant domestication, origin of crops, changes during domestication, genetic regulation of domestication syndromes, evolution of weeds, genetic diversity and domestication. [5]

Crop plants and their wild relatives: Cereal grains (rice, sorghum, wheat), legumes (chickpea, black gram, mung bean, cowpea, moth bean), starch plants (banana, yam), fruits (apple, citrus, grape, peach, strawberry), vegetables (cucurbits) . [5]

UNIT: IV

Morphological variations, systematic position, interrelationships, phylogeny and economic importance of following families: ROSIDS-Rhamnaceae, Moraceae, Urticaceae, Cucurbitaceae, Begoniaceae, Casuarinaceae, Lythraceae, Onagraceae, Myrtaceae, Melastomataceae, Rutaceae, Meliaceae, Sapotaceae, Lecythidaceae, Solanaceae. [15]

ANGIOSPERM TAXONOMY PAPER XV: PRACTICAL COURSE III

UNIT I:

1. Herbarium technique
2. Botanical keys
3. Study of ecotypes/ variations in population of species
4. Identification of taxa with the help of computerized key
5. Study of weeds found in the region
6. Study of crop plants and their wild relatives (cereals and legumes)

UNIT II:

1. Study of crop plants and their wild relatives (Fruit and vegetables)
- 2-6. Description, sketching, classification and identification of families: ROSIDS-Rhamnaceae, Moraceae, Urticaceae, Cucurbitaceae, Begoniaceae, Casuarinaceae, Lythraceae, Onagraceae, Myrtaceae, Melastomataceae, Rutaceae, Meliaceae, Sapotaceae, Lecythidaceae, Solanaceae and identification of wild and cultivated plants represented in local flora.

Any additional practical/s based on theory syllabus will be added whenever necessary.

Reference Books:

Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.

- Cronquist, A. 1988.** The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A.
- Davis, P. H. and V. H. Heywood 1991.** Principles of Angiosperm Taxonomy. Today and Tommorrow Publications, New Delhi.
- Endress Peter, K. 1994.** Diversity and Evolutionary Biology of Tropical Flowers. Cambridge.
- Judd Walter S., Campbell C. S., Kellogg, E. A., Stevens P.F. and M. J. Donoghue 2008.** Plant Systematics-A Phylogenetic Approach. Sinauer Associates, INC, Publishers.Sunderland, Massachusetts, USA.
- Judd Walter S., Campbell C. S., Kellogg, E. A., Stevens P.F. and M. J. Donoghue 2008.** Plant Systematics-A Phylogenetic Approach. Sinauer Associates, INC, Publishers.Sunderland, Massachusetts, USA.
- Lawrence, G. H. M. 1951.** Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi .
- Naik, V. N. 1984.** Taxonomy of Angiosperms. Tata McGraw-Hill, New Delhi.
- Quicke, Donald, L. J. 1993.** Principles and Techniques of Contemporary Taxonomy. Blakie Academic & Professional, London.
- Rao, R. R. 1994.** Biodiversity of India (Floristic Aspects). Bishen Singh Mahendra Pal Singh, Dehra-Dun.
- Rao, R. R. 1994.** Biodiversity of India (Floristic Aspects). Bishen Singh Mahendra Pal Singh, Dehra-Dun.
- Richard, A. J. 1997.** Plant Breeding Systems. (2ed.) Chapman and Hall.
- Shivanna, K. R. and B. M. Johri 1985.** The Angiosperm Pollen: Structure and Function. Wiley Eastern limited, New Delhi.
- Taylor, D. V. and L. J. Hickey 1997.** Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributers, New Delhi.
-

M. Sc. PART-II (SEMESTER IV)
PAPER-XV (BO 4.3.6): MARINE BOTANY
(SPECIAL PAPER III) MARINE ECOLOGY

Total Lectures: 60

UNIT I:

Marine environment: Exposed coasts, estuaries, oceans. **Abiotic factors** - Geological factors- oceans, ocean floor, classification of coasts. Physical factors- light, temperature, water movements (waves, tides, currents), Chemical factors-sea water, salinity, O₂ & CO₂ in sea water, ionic concentration & nutrients. **Biotic factors** –Food webs & chains, succession in marine communities, biological interactions. [12]

Zonation of marine algae: Intertidal, submerged, sublittoral zonation pattern, seasonality.

[3]

UNIT II:

Ecology of mangroves: Morphological, anatomical and physiological adaptations in mangroves. Vivipary and its role in mangroves. Zonation and succession in mangroves.

Faunal components of mangrove habitat- Invertebrates, birds, reptiles, mammals, sediment fauna. [7]

Mangrove conservation, restoration & management [4]

Legal Framework: Forest Conservation Act, Coastal Regulation Zone (CRZ), Biodiversity and wild life act. [4]

UNIT III:

Coastal vegetation and organic matter export: Decomposition, Detritus food chain, marine bacteria, viruses, fungi. Ecological role of microbes. Microbial diversity in mangrove ecosystem - N₂ fixing, PO₄-solubilizing, S-reducing, methanogenic bacteria, Actinomycetes and fungi in mangrove ecosystem. [6]

Coral Reefs: Occurrence, distribution and types. Formation and erosion of coral reefs. Calcification, nutrient cycling, reef micro and macro algae, natural and anthropogenic stresses, management & restoration of coral ecosystem, concept of marine park/ marine protected areas.

[9]

UNIT IV:

Marine pollution: Types, sources, heavy metal pollution-effects on algal metabolism, oil spills, fate of oil and effect on algal metabolism, synthetic organic chemicals-herbicides, insecticides, industrial chemicals (pcbs), complex wastes and eutrophication, pulp mill effluent, domestic wastes, radioactive pollution, biological damage and indirect damage, management and restoration. Biomagnification. [11]

Ecological role of mangrove ecosystem: Screening of solar radiations, control of cyclones, flood, prevention of coastal erosion, support for fishes and wild life population, protection to other ecosystems. [4]

MARINE BOTANY PAPER XV: PRACTICAL COURSE III

UNIT V:

- 1-2. Determination of EC, pH, salinity and chlorinity of seawater.
3. Determination of nitrate content of seawater.
4. Determination of phosphate content from seawater.
- 5-6. Study of salts glands, trichomes, sclereids in mangroves.

UNIT VI:

1. Study of vivipary in mangrove families.
- 2-3. Study of faunal members from mangroves ecosystem.
4. Determination of oil and grease / hydrocarbon content of polluted sea water
5. Study of zonation pattern in mangroves.
6. Determination of sulphate content from marine sediment/soil.

Reference Books:-

Chapman, V. J. (1976). *Costal Vegetation*. 2nd edition Pergamon Press. New York.

Daves, C. J (1985). *Marine Botany Physiology and Ecology of Seaweeds*.

Dawson (1960). *Marine Botany*.

Gerald, E. *Ecophysiology of Economic Plants in Arid and Semiarid Land*.

Lobban, C. S. & Harrison, P. J. (1985). *Seaweed Ecology and Physiology*. Cambridge University Press.

McConnaughey, B. H (1974). *Introduction to Marine Biology*.

- Naskar**, Kumudranjan, Dwijendra Narayan Guha ,Bakshi. Mangrove Swamps of the Sundar bans. An Ecological Perspective. Naya Prakash.
- Naskar**, Kumundrajan and Rathindranath Mandal (1999). Ecology and Biodiversity of Indian Mangroves, Vol. I and II.
- Pandey** B.P. (1994). Algae . S. Chand and Co. Ltd., New Delhi. Current trends in life science, Vol.23: Agromicrobes, Today and Tomarrow. Publ. New Delhi.
- Parsons**, T. R. , Maita,Y & Lalli, C. M. A Manual of Chemical and Biological Methods for Sea Water Analysis.
- Ranade**, D. R. & Gadre, R. V. (1988). Microbial Aspects of Anaerobic Digestion. Laboratory
- Saenger**, P. (2002). Mangrove Ecology, Silviculture and Conservation. Springer.
- Soepadmo**, E. A. N. Rao and Macintosh, D. J. (1988). Proceedings of Asian Symposium. Mangrove Environment Research Management, Kuala Lumpur.
- Stein**, J. R. (1973) Handbook of Phycological Methods. Cambridge University Press.
- Tait**, R. V. (1981) Elements of Marine Ecology.
- Zha**, M. N. (1999). Current Trends in Life Sciences Vol.23, Agromicrobes. Today and Tomorrow . Publi,. New Delhi.

M. Sc. PART-II (SEMESTER IV)
PAPER-XV (BO 4.3.7): PLANT BIOTECHNOLOGY
(SPECIAL PAPER III) APPLICATION AND PROSPECTS OF
PLANT TISSUE CULTURE

Total Lectures: 60

UNIT I:

Application of biotechnology in conservation of plant generic resources: *In-situ* conservation, *Ex-situ* conservation [5]

Application of tissue culture in agriculture: Plant improvement through tissue culture technology; production of resistant lines to biotic and abiotic stresses [10]

UNIT II:

Applications of tissue culture in horticulture, forestry and sericulture: micropropagation of Banana, Bamboo, *Tectona*, *Nothapodytes* and *Morus* [7]

Tissue culture in orchids and *Gerbera* [6]

Prospects in plant tissue culture industry in India; Applications in public sector [2]

UNIT III:

Secondary metabolite production from callus and cell suspension [4]

Biotransformation, process design and product recovery from cultured plant cells. Factors affecting product yield, bioreactors [8]

Secondary metabolites from immobilized plant cells; production of single cells proteins [3]

UNIT IV:

Transgenic plants for crop improvement: Resistance to abiotic stresses (salt, oxidative, herbicide and drought resistance); Resistance to biotic stresses (fungi, insect and virus resistance) [11]

Molecular farming, edible vaccines [4]

PLANT BIOTECHNOLOGY PAPER XV: PRACTICAL COURSE III

UNIT V:

1-2.*In vitro* culture of any RET plant species

3. Screening of cell cultures for abiotic (PEG)/ biotic (fungal) stress
4. Micropropagation of Banana
5. *In vitro* germination of orchid seeds
6. Micropropagation of *Gerbera*

UNIT VI:

- 1-2. Hairy root culture
- 3-4. Production of synseeds and cell immobilization
5. Effect of elicitor (Chitosan) on production of secondary metabolites from cell culture
6. Study of transgenic plants (Bt/ Terminator/ edible vaccines etc.)

Reference Books:

Altman, A. 1998. Agricultural Biotechnology. Marcel Dekker, New York.

Chavala, H. S. 1998. Biotechnology in crop improvement. International Book Distributing Co. New Delhi.

Glick, B. R. and Pasternak, J. J. 1994. Molecular Biotechnology- Principles and applications of recombinant DNA. ASM Press, Washington.

Gupta, P. K. 2000. Elements of Biotechnology. Rastogi Publisher, Meerut, India.

Kakralya, B. and Ahuja, I. 2001. Transgenic Plants-Promise or Danger. Agrobios, India.

Ravishankar, G. A. and Venkataraman, L. V. 1997. Biotechnological applications of plant tissue and cell culture. Oxford and IHB Publishing Co. Pvt. Ltd., New Delhi.

Reddy, S. M., Srivastava, H. P., Purohit, D. K., and Reddy, S. R. 1997. Microbial biotechnology. Scientific Publishers, Jodhpur, India.

Schlegel, H. G. 1995. General microbiology. Cambridge University Press.

Trehan, K. 1994. Biotechnology. Wiley Eastern Ltd. New Delhi.

M. Sc. PART-II (SEMESTER IV)
PAPER-XV (BO 4.3.8): PLANT PROTECTION
(SPECIAL PAPER III) RECENT TRENDS AND TECHNIQUES IN PLANT
PROTECTION

Total Lectures: 60

UNIT I:

Introduction: Recent advances in plant protection. [2]

Pest: Origin, factor responsible, measurements of pest population. [3]

Biotechnology in Plant Protection: -Introduction-Concept and overview of biotechnology, Concept of transgenic plants, applications of biotechnology overview, biotechnology for plant protection: Biotechnology for plant pathology use of viruses in developing transgenic plants, Biotechnology for insect control -BT cotton., biotechnology for weed control- Herbicide resistance and genetic engineering in weed management. [5]

Mycorrhiza: -Introduction and their applications in plant protection. [2]

Koch's Postulates: -Introduction, principles, uses and limitations. [3]

UNIT II:

Residual analysis of pesticides: -Overview of pesticide residues in plants, pesticide residue analysis by-TLC, GC and HPLC. [5]

Culture Media: Overview of culture media, special culture media for Fungi, Bacteria and Mycoplasma. [5]

Biostatistics: -Introduction-Concept of statistics and biostatistics, importance; measures of central tendency- Concept, merits, demerits, applications of Mean, Mode and Median; Measures of dispersion-Concept, merits, demerits, applications of standard deviation, and CV, graphical and diagrammatic representation of data- Histogram, Polygon, Line graph and Pie diagram. [5]

UNIT III:

Remote sensing and lasers in plant protection:

Remote sensing in Plant Protection: -Introduction, concept and components of remote sensing, types of remote sensing, radiations and interactions, types of remote sensing, physical and physiological basis of remote sensing, applications of remote sensing in India. [4]

Laser in Plant Protection: -Introduction, spontaneous and stimulated Emission, Lasers in biology and Plant protection. [2]

Disease forecasting - Concept, prevailing conditions in some diseases, models in diseases forecasting. [4]

Weeds as Pathogens and Weed Management- Weeds and damages caused by them, exotic weeds; weed management: weed research in India, Myco-herbicides and insects in weed management and integrated weed management. [5]

UNIT IV:

IDM - Concept, definition components of IDM, output of IDM in managing various diseases, limitations of IDM. [3]

IPM - Concept, Definition, Historical account, Need and objectives, Strategies and tactics (Direct and indirect). [5]

Autocidal methods - Concept, male sterility method, attractants, repellents, pheromones, Juvenile hormones, Antifeedants. [5]

Plant Protection and Sustainable Agriculture: Concepts, Asian and Indian scenario and future outlooks. [2]

PLANT PROTECTION PAPER XV: PRACTICAL COURSE III

UNIT V

1. To study viability of weed seeds and germination rate.
2. To study mycoflora of soil from crop fields.
3. To study Mycorrhiza and VAM fungi.
4. To Study effect of herbicides on weeds regarding.
 - 1) Relative water content.
 - 2) Chlorophyll content
5. Study of fungal diseases of weeds
 - 1) Powdery mildew of *Portulaca*
 - 2) *Cercospora* on *Eicchornia*
 - 3) Rust of *Euphorbia*
 - 4) Tar Spot disease *Cynadon*
 - 5) Powdery mildew on *Xanthium*.
6. Verification of Koch's postulates. (2 P)

UNIT VI

1. Preparation of special culture media for pathogenic fungi.
2. Mictometry and Biostatistics as per theory syllabus. (2P)
3. Pathophysiology – Estimation of plant pigments.
4. Pathophysiology – Estimation of proteins.
5. Pathophysiology – Estimation of polyphenols.
6. Residual analysis of methyl parathion by TLC.

Reference Books:

Agrios, G. N. (1997). Plant Pathology, 4th Edn. Academic press, San Diego

Aneja K. R.: Experiments in Microbiology, Plant Pathology and Tissue Culture. Wishwa publishers

- Aneja, K. R** (2005). Experiments in Microbiology and Plant Pathology and biotechnology. New Age International (P) Ltd. Publishers, New Delhi.
- Atwal, A. S.** (1936) Agricultural Pest of India and South East Asia. Kalyani Publishers, New Delhi
- Baruah H. K.**, P Brain and A. Baruah, (1984). Textbook of plant pathology. Oxford and IBH Publ. Co., New Delhi.
- Bilgrami K. S.** and **Dube H. C.** (1990). Text book of Modern pathology. Vikas Publishing House Pvt. Ltd. New Delhi.
- Chandrashekharan S. N.** and **S. V. Parthasarthy** (1965). Cytogenetics and Plant Breeding. P. Varadachary and Co. Madras.
- Chatterjee P. B.** (1997). Plant Protection Techniques. Bharti Bhawan. Patana
- Chatterjee, P. B.** (1997) Plant protection techniques. Bharati Bhawan Publishers and Distributors Patna.
- Chattopadhyaya, S. P.** (1987) Principles and Procedures of Plant Protection. Oxford and IBH, New Delhi.
- Dhaliwal, G. S.** and **Arora Ramesh** (1994) Trends in Agricultural Pest Management. Commonwealth Publishers, New Delhi.
- Dickinson M.** (2008). Molecular Plant Pathology. BIOS Scientific Publishers, London and New York.
- Dickison, M. J.** and **J. Beynon** (2000). Annual Plant Reviews, Volume 4-Molecular plant Pathology. Sheffield Academic press, Sheffield.
- Diskson J. C.** (1964) Diseases of Field crop. McGraw –Hill , New Delhi.
- Gerhardson, B** (2002). Biological substitutes for pesticides. *Trends in biotechnology* **20**:338-343. ICAE, Publication.:Crop Diseases Calender
- Jha, L. K.** (1987) Applied Agricultural Entomology. New Central Book Agency, Calcutta.
- Jones D. G.** (1987) Plant pathology – Principles and practices. Open University Press, Stratford.
- Mehrotra R. S.** and **Ashok Aggarwal** (2005) Plant Pathology. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Mehrotra, R. S.** (1980). Plant pathology. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Metcalf, C. L.** and **Flint, W. P.** (1983) Destructive and Useful Insects. Tata McGraw-Hill publishing Co. Ltd. New Delhi.
- Nagarajan S.** (1999) Plant Diseases and Epidemiology. Oxford and IBH, New Delhi.
- Nagarajan, S.** and **K. Mualidharan** (1995) Dynamics of Plant Diseases. Allied Publishers, New Delhi .
- Pathak V. N.** (1980) Diseases of Fruit crops. Oxford and IBH, New Delhi.
- Pedigo, L. P.** (1996) Entomology and pest Management. Prentice-Hall Pub. Englewood cliffs NJ
- Punja, Z. K.** (2001). Genetic engineering of plants to enhance resistance to fungal pathogens-a review of progress and future prospects. *Canadian Journal of plant pathology* **23**: 216-235.
- Ramakrishnan T. S.** (1974) Diseases of Millets. ICAR, New Delhi.
- Rangaswami, G.** (1975) Diseases of crop plants in India. Prentice-Hall Pub, New Delhi.
- Rao V. S.** (1987) Principles of Weed Science. Oxford and IBH, New Delhi.
- Rashid S. N.** and **M. M. A. Khan** : Dictionary of Remote Sensing. Manak Publication Pvt. Ltd., New Delhi.
- Roberts D. A.** and **Bothroyd C. W.** (1995) Fundamental Plant Pathology. W. H. Freeman & Co

- Rommens, C. M. and G. M. Kishore (2000).** Exploiting the full potential of disease resistance genes for agricultural use. *Current Opinions in Biotechnology* **11**:120-125.
- Saha L. R. (1990)** Hand Book of Plant Protection. Kalyani Publ. New Delhi.
- Saha, L. R. and Dhaliwal G. S. (2006)** Handbook of Plant Protection. Kalyani Publ. New Delhi.
- Sambamurty, A. V. S. S. (2008).** Molecular biology. Narosa Publishing House, New Delhi. ISBN 978-81-7319-837-3.
- Schillberg, S., S. Zimmermann, M. Y. Zhang and R. Fisher (2001).** Antibody-based resistance to plant pathogens. *Transgenic research*.**10**:1-12.
- Shrivastava, V. P. (1988).** A Textbook of Applied Entomology. Kalyani Publ. New Delhi
- Sill Webster H. (1983).** Plant Protection. Iowa State Univ.Press
- Singh Tribhuwan and K. Agarwal (2001).** Seed Technology and Seed Pathology, Pointer Publishers, Jaipur-302003 (Raj), India. ISBN 81-7132-284 -0
- Singh, R. S. (1998)** Plant Diseases. Oxford & IBH Publ.
- Singh, R. S., U. S. Singh, W. M. Hess and D. J. Weber (1988).** Experimental and conceptual plant pathology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- Stuiver, M. H. and J. H. H. V.Custers (2001).** Engineering disease resistance in plants. *Nature* **411**: 865-868.
- Suryanaryana, D. (1974)** Seed pathology. Vikas New Delhi
- Tepfer, M. (2002).** Risk assessment of Virus-resistant transgenic plants. *Annual Review of Phytopathology***40**:467-491.
- Journals :** 1. Crop Protection 2. Geobios 3. Journal of Entomological Society of India.
-

M. Sc. PART-II (SEMESTER IV)
PAPER-XV (BO 4.3.9): PLANT DIVERSITY
(SPECIAL PAPER III) BIODIVERSITY AND SUSTAINABLE DEVELOPMENT

Total Lectures: 60

UNIT I:

Biodiversity and sustainable development: Concept, prospects and concern, biodiversity education, rehabilitation of neglected specialized habitats like wetlands and mangroves, community participation for sustainable development, social approach to conservation, role of universities and educational institutes in biodiversity conservation. [8]

Plant bioresources of Western Ghat: Wild edible fruit plants, gum, resins, dyes, medicine, fodder ornamental, fibre, timber, essential oil fuel, honey yielding plants (minimum five plants from each category). [7]

UNIT II:

Local biodiversity: Diversity of angiosperms of Satara with special reference to Mahabaleshwar, Kas, Khatav, Ajinkyatara fort and Vasota. [8]

Domesticated biodiversity: Domesticated biodiversity in India and its conservation, organization, working and role of NBPGR. [7]

UNIT III:

Bioprospecting and biodiversity: Concept, bioprospecting and indigenous traditional knowledge, bioprospecting for conservation and sustainable development, Rio convention (1992) and bioprospecting, bioprospecting and biopiracy, bioprospecting to conserve the biodiversity, intellectual property right. [8]

Cellular and molecular aspects of biodiversity: Cellular diversity of photosynthetic pigments, diversity of soil microbes and marine prokaryotes, molecular diversity at the level of rRNA, metabolic diversity in response to environment and genomic diversity of higher organism. [7]

UNIT IV:

Agrobiodiversity: Origin and development, history of domestication of plants, centers of diversity of cultivated plants, recent methods of cultivation in agriculture and management of agrobiodiversity. [15]

PLANT DIVERSITY PAPER XV: PRACTICAL PAPER III

UNIT V:

1. Assessment of Biodiversity of local area (Kas, Ajinkytara fort, Mahabaleswar) by suitable sampling methods (Quadrat, line transect and belt transect) for determination of frequency, species abundance and species area curve
2. Extraction and isolation of secondary metabolites from natural sources.
3. Extraction of phytochemicals from natural resources and screening for antimicrobial/anti-inflammatory compounds from them.
- 4 to 6 To study domestication of wild/Ornamental/Edible/medicinal Plants
 - A Germination Study
 - B Water requirement
 - C Soil requirement
 - D Light requirement

UNIT VI:

- 7&8 Study of wild Species used in crop improvement
- 9 Field activity related to sustainable development (Plantation drive involving local people, awareness programme for villagers with special focus on RET and endemic plants)
- 10 Study of antioxidants properties of any one plant species by DPPH method (From leaves or Fruits)
- 11 Study of centres of diversity of cultivated plants
- 12 Study of gum, resin, dye, fibre, timber yielding plants

Reference Books:

Narasaiah M L 2005 Biodiversity and Sustainable Development; Discovery Publishing House

Khan T I 1998 Biodiversity Conservation and Sustainable Development; Pointer Publisher

Panigrahy R. L. and Lingaraj Patro 2008 Biodiversity Conservation and Sustainable Development; Discovery Publishing House

Gupta, P. K. 2010. Plant Biotechnology. Rastogi Publications, Meerut.

Glick, B, R. and Pasternak, J. J. 1994. Molecular Biotechnology- Principles and Applications of Recombinant DNA. ASM Press, Washington D. C.

Gupta, P. K. 2009. Biotechnology and Genomics. Rastogi Publications, Meerut.

Trehan, K. 1994. Biotechnology. Wiley Eastern Limited, New Delhi.

Ramawat, K. G. 2006. Plant Biotechnology. S. Chand and Company Ltd., New Delhi.

Trivedi, P. C. (ed.) 2000. Plant Biotechnology- Recent Advances. Panima Publishing Corporation, New Delhi.

Kochhar S L 2009 Economic Botany in the Tropics; Macmillan

Verma V 2009 A textbook on Economic Botany; Ane Books Pvt Ltd

Kumar, H. D. 1993. Molecular Biology and Biotechnology, Vikas Publ., New Delhi.

Wood D and Lenne' J 1999 Agrobiodiversity: Characterization, Utilization and Management; CABI Pub

.....

M. Sc. PART-II (SEMESTER IV)
PAPER-XVI (BO 4.4.1): PLANT PHYSIOLOGY
(SPECIAL PAPER IV) APPLIED PLANT PHYSIOLOGY

Total Lectures: 60

UNIT I:

Crop growth and its regulation: Growth analysis of crop plants and its significance. Factors controlling crop productivity, Harvest Index (HI), Water Use Efficiency (WUE). [5]

Nutriophysiology: Classification of mineral nutrients according to function. Factors influencing mineral uptake. Foliar diagnosis of critical nutrient status. Physicochemical properties of soil, lime and gypsum as soil additives. Role of chelates in mineral utilization. Foliar applications of mineral elements. Biofertilizers, CO₂ as a fertilizer. [10]

UNIT II:

Reproductive physiology: Role of PGRs in flowering, sex determination and fruit development. Ethylene and post harvest physiology. [9]

Source-Sink relationship in crop plants and its significance. [6]

UNIT III

Plant growth regulators in agriculture and horticulture: Mode of applications of PGR's

Pre sowing soaking treatment, foliar application and other modes

Roles: Ethylene and ethylene generating compounds, long chain alcohols, Brassinosteroids, plant growth retardants, amino acid mixtures and other commercial products. Bionics. [15]

UNIT IV:

Invading weeds, crop-weed interaction, weedicides and their mode of action [8]

Physiological aspects of transgenic crops. [4]

A brief idea of crop physiological research in India. [3]

PLANT PHYSIOLOGY PAPER XVI: PRACTICAL COURSE IV

UNIT V:

- 1- 2. Growth analysis of any two crop plants (RGR, NAR, LAR, LAI, etc.)
- 3- 4. Determination of N, P and K status of soil and crops
5. Study of effect of source manipulation on sink capacity in any crop plant.
6. Study of effect of weedicides on some aspects of weed metabolism (chlorophylls/nitrate reductase)

UNIT VI:

- 1-2. Effect of pre sowing-soaking treatments of PGRs on crop growth.
3. Determination of Harvest Index (HI) of different crops (Wheat and chickpea)
- 4-5. Effect of foliar applications of some commercial PGR's and biotonics on crop productivity parameters (carbohydrate status).
6. Effect of soil conditioners and biofertilizers on crop growth.

Reference Books:-

Asana, R.D. and Sarin, M.N. (1968) Crop physiology in India. Tech. Bull. 16.

Indian Coun. Agric. Res. (Agric. Ser.)

Buchnan, B.B., Gruissem, W. And Jones, R.L. (2000) Biochemistry and Molecular Biology of Plants. Wiley-Blackwell

Evans, L.T.(1972): Crop Physiology. Some Case Histories. Cambridge, NY

Fageria, N. K. (1992): Maximizing crop yield. CRC Press

Fitter, A.H. and R.K.M. Hay (1987) Environmental Physiology of Plants.(Second Edition) Academic Press, San Diego, CA

Gupta U.S. (1988) Progress in Crop Physiology. Oxford and IBH. Pub. Co.

Gupta U.S. (1995) Production and Improvements of Crops for Drylands. Oxford and IBH. Pub. Co.

Krishnamurthy, H.N. (1992): Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.

Nickell, L.G. (1982) Plant Growth Regulators- Agricultural Uses. Springer-Verlag, New York

Pessaraki, M. (Ed.). (2001). Handbook of Plant and Crop Physiology, 2nd Edition, Revised and Expanded. Marcel Dekker, Inc., New York

Taiz, L. and Zeiger, F. (1998, 2002, 2008): The Plant Physiology. (Second Edition 1998, Third Edition 2002, Fourth Edition 2008) Sunderland: Sinauer Associates.

Journals

Annual Review of Plant Physiology and Molecular Biology.

Annual Review of Plant Physiology

Indian Journal of Plant Physiology.

Journal of Experimental Botany.

Physiologia Plantarum Sweden.

Plant Physiology (Bethesda, USA).

Plant Cell.

M. Sc. PART-II (SEMESTER IV)
PAPER-XVI (BO 4.4.2): MYCOLOGY & PLANT PATHOLOGY
(SPECIAL PAPER IV) INTEGRATED DISEASE MANAGEMENT

Total Lectures: 60

UNIT I:

Methods of disease diagnosis: Field observation, isolation and identification of Pathogens.

[5]

Integrated management of plant diseases: Definition of IDM, international approach, Quarantine laws, Culture methods, avoidance of pathogen, breeding and use of disease resistant varieties. Seed certification.

[10]

UNIT II:

Chemical methods, formulation and classification of fungicides, contact and systemic fungicides, uptake and mode of action. Seed, soil, plant treatments of fungicides, fungicide resistance in plant pathogens and their management. Antibiotics and biological control of plant pathogenic fungi. Biological control agents, VA-Mycorrhiza, *Trichoderma viride*, *T. harzianum*, *Pseudomonas fluorescens*, *Glomus* spp. Use of botanicals and other biopesticides.

[15]

UNIT III:

Integrated management of some important diseases-History, symptomology, pathogen, etiology and management: Jowar (Head and Grain smut), Bajara (Green ear), Wheat (Rust and Bunt), Rice (Blast), Groundnut (Leaf spot and Rust), Sunflower (Downy mildew), Soybean (Mosaic), Cotton (Angular leaf spot).

[15]

UNIT IV:

Integrated management of some important diseases-Sugarcane (Whip smut and Grassy shoot), Banana (Blight), Citrus (Canker), Grapes (Powdery mildew, Anthracnose, Downy mildew), Pigeon pea (Wilt), Bendi (Yellow vein mosaic virus), Potato (Early and late blight), Tomato (Early blight).

[15]

MYCOLOGY AND PLANT PATHOLOGY PAPER XVI: PRACTICAL COURSE IV

UNIT V:

1. Study of air borne fungi using air sampler.
- 2-3. Spore germination of pathogenic fungi on two different media.
- 4-5. Evaluation of fungicides and antibiotics against pathogen by spore germination (food poisoning technique).

6. Formulation of organo-molecular fungicides.

UNIT VI:

- 1-2. Synergistic effect of agrochemicals in the management of crop diseases.
3. Symptomology of the diseases mentioned in the theory.
4. Histopathology of the disease mentioned in the theory.
- 5.6. Collection and preservation of plant diseases.

References Books:

Lalithakumari D. (2000). Fungal Protoplast: A Biotechnological Tool: Oxford and IBH Publishing Co. Pvt.Ltd.

Mathews, R. E. F. (1970). Plant Virology. Academic Press, New York

Tilak, S.T. (1998). Aerobiology. Satyajeet Prakashan

Kenneth M. Smith (1968). Plant Viruses. Academic Press, New York

Bawden, F. C. (1964). Plant Viruses and Virus Diseases. Biotech Books, New Delhi

Mehrotra, R. S. (1980). Plant Pathology Tata McGraw-Hill Publishing Company Ltd.

Agrios, G. N. (2006). Plant Pathology (5th Edition). Academic Press, New York

Ny Vall, R. F. (1979). Field Crop Diseases Handbook. Wiley

Singh, R. S. (1963). Plant Diseases.—

Padoley, S. K. and P. B. Mistry: A manual of Plant pathology. International Book House, New Delhi

Gangopadhyay, S. (1984): Clinical Plant Pathology Kalyani Publishers

.....

M.Sc. PART-II SEMESTER IV

PAPER-XVI (BO 4.4.3): CYTOGENETICS AND PLANT BREEDING

**(SPECIAL PAPER IV) SPECIAL APPROACHES IN GENETIC IMPROVEMENT OF
CROP PLANTS**

Total Lectures: 60

UNIT I:

- Functional genomics: Genome annotation [5]
RNA interference mechanism, synthesis and its applications, Virus induced gene silencing (VIGS), VIGS in plant genomic research [5]
Transcriptomics and methods of transcriptome analysis [5]

UNIT II:

- Quantitative trait loci (QTL), Methods of QTL analysis by using molecular markers [5]
Allele Mining for crop improvement: Approaches for allele mining, significance of novel alleles, applications of allele mining [4]
Marker assisted selection for crop improvement: Selection of markers, breeding schemes involved, gene pyramiding applications of MAS [4]
Epigenetics and Epigenomics for crop improvement [2]

UNIT III:

- a) Tissue Culture: Anther culture, production of haploids, embryo rescuing and its uses in crop improvement. [5]
b) Production of secondary metabolites, cell line isolation, hairy root culture with some important secondary metabolite production and use of bioreactors [5]
c) Production of biotic and abiotic resistant plants using tissue culture. [5]

UNIT IV:

- Transgenics:** a) Methods of gene transfer and its expression [4]
b) Transgenic crops for biotic and abiotic stresses, nutritional quality improvement, [8]
c) Transgenic crops field testing and regulatory measures [3]

CYTOGENETICS AND PLANT BREEDING PAPER XVI: PRACTICAL COURSE IV

UNIT V:

1. *In silico* studies (Identification of SSRs, Primer designing and Similarity search analysis using different BLAST programs)
2. Preparation of linkage map using mapmaker and join map
- 3-4. QTL analysis using QTL Cartographer and QTL Network
5. EST analysis in crops
6. Study of polymorphism in crop plants using molecular markers

UNIT VI:

1. Secondary metabolite production and analysis
2. Anther culture and haploid production
3. Cell line isolation
4. Hairy root culture
5. Study of transgenic plants
6. Detection and estimation of protease inhibitors from cereals/pulses

Reference Books:

- Thimmaiah S. R.** 1999, Standard methods of biochemical analysis. Kalyani Publishers Ludhiana.
- Mitra Sandhya** 1996, Genetic Engineering Macmillan India Ltd.
- Lal R. and Lal S.** 1993, Genetic engineering of plants for crop improvement. CRC Press.
- Winkler, U. Ruger W. and Wackernagel W.** 1979. Bacterial phage and molecular genetics. Narosa Publication New Delhi.
- Chawala H. S.** 2000 Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd.
- Vidhyashekar P.** 1993 Molecular biology and tissue culture for crop pest and disease management. Daya Publishing House New Delhi.
- Kumar U.** 2005 Methods in Plant Tissue culture Agrobios Jodhpur India.
- Razdan M. K.** 2003 Introduction to plant tissue culture. Oxford and IBH publishing Co. Pvt. Ltd.
- Gustafson J. P.** 1990 Gene manipulation in plant improvement I and II. Plenum Press London.
- Old R. W. and Primrose S. B.** 1989 Principles of Gene Manipulation. Blackwell Scientific Publ Oxford UK.
- Razdan M. K. and Cocking E.C.** 2000 Conservation of plant genetic resources in vitro. Oxford and IBH publishing Co. Pvt. Ltd.
- Razdan M. K. and Bhojwani S. S.** 1996, Plant tissue culture: Theory and practice a revised edition. Elsevier Science.
- Gupta P. K.** 2010 Plant Biotechnology. Rastogi Publications Meerut.
- Singh B. D.** 2003 Biotechnology Expanding Horizons. Kalyani publishers Ludhiana.
- Trigiano R. N. and Gray D. J.** 2000 Plant tissue culture concepts and laboratory exercises. CRS press LLC.
- Manibhushanrao K. and Mahadevan A.** 1996 Recent developments in biocontrol of plant

pathogens. Today and Tomorrow's printers and publishers New Delhi.

Reinert J. and Bajaj Y. P. S. 2000 Plant cell, Tissue and Organ culture. Springer –Verlag.
New York,

Chrispeels M. J. and Sadava D. E. 1994 Plants, Genes and Agriculture. Jones and Barlett
Publishers Boston, USA.

Gustafson J. P. 2000 Genomes. Kluwer Academic Plenum Publishers New York USA.

Brown T. A. 1999 Genomes. John Wiley and Sons Pvt. Ltd. Singapore.

Liu Ben Hui 1998 Statistical Genomics :Linkage Mapping and QTL Analysis. CRC Press LLC
Florida USA.

Wennacker Ernst L. 1987 From Genes to Clones; Introduction to Gene Technology VCH
publishers Weinheim (Federal Republic of Germany)

Mount D. W. 2001 Bioinformatics Sequence and Genome Analysis. Cold Spring Harbour
Laboratory. New York.

Jagota A. 2000 Data Analysis and Classification for Bioinformatics. Published by
Bioinformatics by the bay Press. University of Michigan, USA

Durbin R, Sean R., Eddy, Anders Krogh, Graeme M.1999 Biological Analysis-Probabilistic
Models of Proteins and Nucleic Acids. Cambridge University Press.

Andreas Baxevanis, B. F. Francis Ouellette and B. F. Cuellette 1998 Bioinformatics : A
Practical Guide to the analysis of Genes and Proteins, Wiley Publishers, New York

Journals:

1. Indian Journal of Biotechnology
 2. Indian Journal of Experimental Biology
 3. Journal of Experimental Botany
 4. Trends in Biotechnology (Elsevier)
 5. Trends in biochemical Sciences (Elsevier)
 6. Journal of Molecular Plant Pathology
 7. Journal of Plant Biotechnology
 8. International Journal of Food Science and Technology.
-

M.Sc. II PART- II (SEMESTER IV)
PAPER- XVI (BO 4.4.4): ENERGY, ECOLOGY & ENVIRONMENT
(SPECIAL PAPER IV) ENVIRONMENTAL ISSUES, ASSESSMENT AND
RESTORATION

Total Lectures: 60

UNIT I:

Air pollution: Acidic precipitation, causes and consequences. Air pollution monitoring devices. [6]

Water pollution: Classification of water pollutants. Oxygen demanding pollutants and their activity. Pathogens, nutrients, salts, heat, heavy metals and pesticides. Radioactive and oil pollutants. Self purification of natural streams. Oxygen sag analysis. [9]

UNIT II:

Environmental issues: Ozone – Positive and negative influence of ozone.
Air quality loss, nuclear winter, vehicular and industrial gases, global climate change
Land degradation: loss of soil fertility, mining etc. [15]

UNIT III:

Environmental impact assessment: Methodology, Indian and global scenario [8]
Environmental auditing and monitoring. Role of plants and microbes. [7]

UNIT IV:

Ecology and human welfare:

Natural resources: Conservation and management, recycling of resources, waste management. [12]

Ecotourism and Ecofriendly measures: [3]

ECOLOGY PAPER XVI: PRACTICAL COURSE IV

UNIT V:

1. Study of biological indicators.
2. Study of IUCN red list categories.
3. Study of micro and macrophytes.

- 4.5. Effect of effluents on soil microflora.
6. Study of garbage types and their analysis.

UNIT VI:

1. Measurement of vehicular pollution / noise pollution.
2. EIA exercise.
- 3-4. EIA Reporting.
5. Comparison of plant communities from polluted and non-polluted areas.
6. Measurement of dust fall.

Reference Books:

- Adriano, D. C. and Johnson, A. H.** (1989): Acidic precipitation, vol. II. John Wiley *Publishers*.
- Balkrishnan, M., Borgstrom, R. and Bie, S. W.** (1994): Tropical Ecosystems. Oxford and IBH *Publishing Co.*
- Dash, M. C.** (1993): Fundamentals of Ecology. Tata Mc.Graw Hill *Publishing Company Ltd.* New Delhi.
- De, A. K.** (1994): Environmental Chemistry. New Age international *publishers*.
- Good, R. E. et al** (1978): Fresh water wetlands. Margraf *Publishers*.
- Gregory S.** (1988): Recent climatic changes: A regional approach. Kluwer Academic *Publisher*.
- Lal, J. B.** (1987): Environmental Conservation. *Publisher:* International Book Distributors.
- Misra K. C.** (1989): Manual of plant ecology. Oxford and IBH Publishing Co., New Delhi.
- Owen, M. and Black, J. M.** (1990): Waterfall Ecology. Blackie *Publishers*, Glasgow, Scotland.

M. Sc. PART-II (SEMESTER IV)
PAPER-XVI (BO 4.4.5): ANGIOSERM TAXONOMY
(SPECIAL PAPER IV) PHYLOGENY AND FLORAL BIOLOGY OF
ANGIOSPERMS

Total Lectures: 60

UNIT I:

Origin of Angiosperms: Pre-cretaceous and Cretaceous fossil angiosperms, time of origin of angiosperms, cradle of angiosperms, probable ancestors of angiosperms- *Isoetes*-monocotyledon theory, Coniferales-amentiferae theory, Gnetales-angiosperm theory, Anthostrobilus theory, Caytonian theory, Stachyosporo-phyllaspermae theory, Pteridosperm theory, Pentoxylales theory and Durian theory, monophyletic versus polyphyletic origin of angiosperms. [9]

Fossil Angiosperms of India: A brief account of fossil angiosperms of India- Palmae: *Palmoxylon*, *Rhizopalmoxylon*, *Palmocarpon*; Cyclanthaceae: *Cyclanthodendron*, *Tricoccites*; Pandanaceae: *Viracarpon*; Musaceae: *Musa cardiospermum*; Gramineae: *Graminocarpon*; Sonnertiaceae: *Sonnertioxylon*, *Sonnertiorhizos*, *Sahnianthus*, *Enigmocarpon*; Guttiferae: *Indocarpa*, Myrtaceae: *Sahnipushpam*; Malvaceae: *Sahniocarpon*, *Harissocarpon*, *Daberocarpon*, *Chitaleypushpam*. Fossil angiosperms and palaeoecology of India. [6]

UNIT II:

Floral Biology-I: Evolution of flower, evolution of floral biology in basal angiosperms, co-evolution of flowering plant and insects, sex in flowers, sex distribution in plants, types of pollination, chasmogamy and cleistogamy; biology of floral parts-calyx, corolla, androecium, pollen, style and stigma. [15]

UNIT-III

Floral Biology-II: Anemophily, hydrophily, ornithophily, cheiropterophily, entomophily-beetle, fly, bee, wasp, *Catasetum*, fig wasp, butterfly, moth, carpenter bee pollination; floral diversity and evolutionary steps toward asclepiad flowers. [15]

UNIT IV

Morphological variations, systematic position, interrelationships, phylogeny and economic importance of following families: ASTERIDS-Convulvaceae, Boraginaceae, Rubiaceae,

Apocynaceae, Oleaceae, Scrophulariaceae, Bignoniaceae, Lentibulariaceae, Verbenaceae,
Lamiaceae [15]

ANGIOSERM TAXONOMY PAPER XVI: PRACTICAL COURSE IV

UNIT V:

1. Study of characters of anemophilous flowers.
2. Study of characters of hydrophilous flowers.
3. Study of characters of cheiropterophilous flowers.
- 4-6. Study of characters of flowers entemophilous: bee, carpenter bee, fly, moth, butterfly and wasp flowers

UNIT VI:

1. Study of fossil angiosperms of India with the help of slides and specimens
- 2-6. Descriptions, sketching, classification and identification of families: ASTERIDS- Convolvulaceae, Boraginaceae, Rubiaceae, Apocynaceae, Oleaceae, Scrophulariaceae, Bignoniaceae, Lentibulariaceae, Verbenaceae, Lamiaceae and
Identification of wild and cultivated plants represented in local flora.
Any additional practical/s based on theory syllabus will be added whenever necessary.

[In second term of IV Semester, at least two local tours and an excursion of about one week duration has to be conducted for students opting for, 'Taxonomy of Angiosperms' as their specialization to study vegetation, pollination mechanism, ecology and flowering plant species of suitable region. Student has to submit herbarium specimens (50), permanent or semi permanent slides (5) preserved plant specimens, tour report, laboratory work-book and project work report (if any) at the time of practical examination].

Reference Books:

Cronquist, A. 1988. The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A.

Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.

Davis, P. H. and V. H. Heywood. 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi.

- Manilal, K. S. and M. S. Muktesh Kumar [ed.].** 1998. A Handbook of Taxonomic Training. DST, New Delhi.
- Naik, V. N.** 1984. Taxonomy of Angiosperms Tata McGraw-Hill Publication Com. Ltd. New Delhi.
- Quicke, Donald, L. J.** 1993. Principles and Techniques of Contemporary Taxonomy. Blakie Academic & Professional, London.
- Rao, R. R.** 1994. Biodiversity of India (Floristic Aspects). Bishen Singh Mahendra Pal Singh, Dehra-Dun.
- Taylor, D. V. and L. J. Hickey.** 1997. Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributers, New Delhi.
- Lawrence, G. H. M.** 1951. Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi .
- Shivanna, K. R. and B. M. Johri.** 1985. The Angiosperm Pollen: structure and Function. Wiley Eastern limited, New Delhi.
- Endress Peter, K.** 1994. Diversity and Evolutionary Biology of Tropical Flowers. Cambridge.
- Richard, A. J.** 1997. Plant Breeding Systems. (2ed.) Chapman and Hall.
- Nayar, M. P.** 1996. Hot Spots of Endemic Plants of India, Nepal and Bhutan. Tropical BotanicaGardens and Research Institute, Palode, Kerala
- Ahmedullah, M. and M. P. Nayar.** 1987. Endemic Plants of the Indian Region Vol I. Botanical Survey of India.
- Synge, Hugh (ed.).** 1980. The biological aspects of Rare Plant Conservation. John Wiley & Sons.
- Judd Walter S., Campbell C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue.** 2008. Plant Systematics. Sinauer Associates, INC, Publishers. Sunderland, Massachusetts, USA.
- Percival, M. S.** 1965. Floral Biology. Pergamon Press, London.
-

M. Sc. PART-II (SEMESTER IV)
PAPER XVI (BO 4.4.6): MARINE BOTANY
(SPECIAL PAPER IV) APPLIED MARINE BOTANY

Total Lectures: 60

UNIT I:

Primary Production: Overview, GPP and NPP, Oceanic Production, effect of light and nutrients, Biomass harvesting/ harvest method, litter fall, chlorophyll method, gas exchange technique. Standing crop, light and dark bottle method, ecological indices. [8]

Methods of Mangrove Analysis: Collection by field methods-Transect, Quadrant, Phytosurvey. Geological Methods-Location, Elevation, Use of remote sensing technique in mapping of mangrove vegetation, Use of GPS. [7]

UNIT II:

Collection and Preservation of Marine Algae: Methods of collection, chemical preservation, herbarium technique. [3]

Seaweed Mariculture: Commercial cultivation of economic seaweeds, Scientific bases for seaweed mariculture, Techniques of seaweed mariculture- *Porphyra*, *Laminaria*, *Undaria*, *Kappaphycus*, *Gracilaria* etc Future prospects: [12]

UNIT III:

Utilization of Seaweeds: Human food, sea vegetables, fodder, fertilizer and manure, kelp industry, antibiotics and drugs, phycocolloids and their applications. Algal Products- Soda and Potash, Iodine, Trace elements. Use of algae as Bio fuel. [10]

Laboratory Culture of Algae : Use of natural and synthetic culture media, types of culture, requirements/conditions of growth, difficulties in getting axenic culture. [5]

UNIT IV:

Coastal Bioresources: Bioresource profile. Wild bioresources - food, feed, fodder, fire wood, timber, medicinal products, potential genetic resources, ornamentals. Domestic bioresources - crops, cereals, pulses, oil crops, horticultural crops, live stock, aquaculture, apiculture. [5]

Nursery Techniques in Mangroves: Nursery practices-collection of seed/ propagule/seeding material, storage, sowing of seeds, shading, watering, disease control and transplantation. [6]

Mangrove Plantation Techniques: Direct and indirect method- zonation, season, gap filling, soil condition etc. [4]

MARINE BOTANY PAPER XVI: PRACTICAL COURSE IV

UNIT V:

1. Determination of primary productivity of estuarine ecosystem.
2. Study of herbarium technique in marine algae.
- 3-4. Collection and identification of marine diatoms (cleaning, preparation and observation)
5. Demonstration of phytoplankton / algal culture technique.
6. Determination of total ash/mineral content from seaweeds.

UNIT VI:

- 1-2. Effect of seaweed concentrate/manure on seed germination and plant growth.
3. Determination of starch content from edible mangrove fruits.
4. Study of major faunal components from mangrove ecosystem.
5. Determination of total antioxidant activity in seaweeds/ mangroves
6. Determination of vitamin content from edible mangroves/ seaweeds.

Reference Books:

Beck. Biotechnology of Microalgae.

Bhosale, L. J.(2005). Mangroves of Maharashtra. (Field Guide). Shivaji University,Kolhapur.

Chapman,V. J. (1976). Costal Vegetation. II nd edition Pergamon Press. New York.

Jackson. D. F. (1972). Algae and Man. Plenum Press.

Kannupandi, T. (1998). Coral Reefs of India. State of Art Report. ENVIS Publication Series 2/98.

Krishnamurthy, V. (1985). Marine Plants. (A.G. Untawale, Asso. Editor), Seaweed Research and Utilization Association, Madras.

Santhanam, R.; Ramnathan,N.; Venkataramanjan K. & Jegathanam,G. (1987) .

Phytoplankton of Indian Seas. & Aspects of Marine Botany.Daya Publication Home. Delhi.

Stein, J. R. (1973) Handbook of Phycological Methods. Cambridge University Press.

Stoermer, E. F. & Smol, J. P. The Diatoms. Applications for Environment and Earth

Sciences

Swaminathan M. S. Research foundation (2003). Bioresources Status in Selected Coastal

Location. National Bioresource Development Board (Department of Biotechnology)

Govt. of India.

Trainor, F. R. Introductory Phycology.

M. Sc. PART-II (SEMESTER IV)

PAPER-XVI (BO 4.4.7): PLANT BIOTECHNOLOGY (SPECIAL PAPER IV)

APPLICATION, REGULATION AND PATENTING BIOTECHNOLOGY

Total Lectures: 60

UNIT I:

Biotechnology in Agriculture: Bioethical principles for agricultural biotechnology, ethical aspects and public acceptance [5]

Biological Nitrogen Fixation: Mechanism of N₂ fixation, Symbiotic N₂ fixation, Mechanism of N₂ fixation in root nodules, Nod genes, Nif genes, Hup genes [7]

Use of microbes in Industry and agriculture [3]

UNIT II:

Application of biotechnology in environmental protection: Pollution control, phytoremediation immobilized microbial cells, wastewater treatment, microbes in leaching of metals [10]

Economic and legal issues of biotechnology [5]

UNIT III:

Regulating the use of biotechnology in recombinant DNA technology, food, food ingredients and GMO's – cost benefit analysis of GMO's [6]

Global biotech scenario, public verses private enterprises, international organizations involved in biotechnological inventions, cooperative programmes [5]

Biotechnological spotlights [4]

UNIT IV:

Intellectual property; Intellectual Property Rights (IPR) and its protection, IPR and Plant Genetic Resources, GATT and TRIPS [5]

Patent systems in India, sources of patent information: a case study [5]

Patenting biotechnological inventions: Patent of higher plants, patent of genes and DNA sequences, plant breeder's right and farmer's right [5]

PLANT BIOTECHNOLOGY PAPER XVI: PRACTICAL COURSE IV

UNIT V:

- 1-2. Collection, identification and conservation of land races of crop plants
- 3-4. Preparation of questionnaire for acceptance of biotech products
- 5-6. Culture of *Thiobacillus* and its use in bioleaching

UNIT VI:

- 1-2. Use of bioscavengers in water and soil treatment
- 3-4. Culture of *Trichoderma*
- 5-6. Formulation of patent proposal

Reference Books:

Altman, A. 1998. Agricultural Biotechnology. Marcel Dekker, New York.

Gupta, P. K. 2000. Elements of Biotechnology. Rastogi Publisher, Meerut, India.

Glick, B. R. and Pasternak, J. J. 1994. Molecular Biotechnology- Principles and applications of recombinant DNA. ASM Press, Washington.

Mitra, S. 1996. Genetic Engineering- principles and practice. Mcmilan, India ltd.

Technology information, forecasting and assessment council (**TIFAC**). 2002. Sources of patent information and patent agents. Technology Bhavan, New Delhi.

Technology information, forecasting and assessment council (**TIFAC**). 2002. Lecture notes on patents. Technology Bhavan, New Delhi.

.....

M. Sc. PART-II (SEMESTER IV)
PAPER-XVI (BO 4.4.8): PLANT PROTECTION
(SPECIAL PAPER IV) MOLECULAR PLANT PATHOLOGY

Total Lectures: 60

UNIT I:

Fundamentals of plant pathology and application of molecular biology to conventional disease control strategies:

The Fundamentals of plant Pathology: -The concept of plant diseases; The causal agents-fungi, protozoa, bacteria, phytoplasmas and spiroplasmas, viruses and other agents; Molecular biology in plant pathology. [6]

Application of Molecular Biology in Disease Control : Breeding for resistance: The basis of resistance breeding programme, the conventional and non conventional breeding strategy; Marker assisted breeding; The identification of novel resistance gene specificities [9]

UNIT II:

Disease resistance in plants:

Resistance Mechanism in plants: -Classical concept of resistance, Pre-formed defenses, Induced defenses, Systematic resistance mechanism and communal resistance. [6]

Signaling in Plant Disease Resistance Mechanism: Genetic analyses, MAP kinases (MAPK), Ion fluxes and calcium homeostasis, Oxidative bursts, Nitric oxide (NO), (p)ppGpp signaling molecules, Low molecular weight signaling molecules, RNA as a signal. [9]

UNIT III:

Resistance genes, genetics of plant pathogen interactions, and genetics of fungi:

Resistance gene: - Gene- for gene resistance, Features of cloned resistance genes, R gene specificity, Genetic organization of resistance genes, Mechanism of generating new R gene specificities, Co-evolution of resistance genes, Recessive resistance genes, Quantitative resistance. [7]

Genetics of Plant Pathogen Interactions: -Genetics of host Parasitic interactions, Physiological specialization in fungi, Production of New races, Adaptations of fungi to different Hosts, Resistance and Susceptibility [8]

UNIT IV:

Molecular diagnostics and application to conventional disease control:

Molecular Diagnostics: Classical approaches; Use of antibodies-Polyclonal antibodies, Monoclonal antibodies, Recombinant DNA techniques; Serological Tests-ELISA, Lateral flow

techniques, other uses of antibodies; Nucleic acid based techniques- Identification of pathogen specific markers, Hybridization techniques, PCR based technique, Gene-array based techniques, Quantitative PCR; and Phylogenetic analysis. [8]

Transgenic approaches for crop protection:

Pathogen derived resistance - Coat –protein mediated resistance, Replicate mediated resistance, Movement protein mediated resistance, RNA mediated resistance, Pathogen derived resistance against bacterial and fungal diseases; Plantibodies; Overexpressing defense genes; Expressing defense genes under the control of inducible promoters; Use of clonal resistance genes; Engineering broad –spectrum resistance; Resistance based on antagonistic microbes; and Expression of vaccines in plants. [7]

PLANT PROTECTION PAPER XVI: PRACTICAL COURSE IV

UNIT V

- 1-3 Isolation and identification of fungal pathogen from leaves stem and fruits.
4. Isolation and identification of bacterial plant pathogens.
5. Production of pathogen free plants through meristem culture.
6. Isolation of antibiotic resistant bacteria.

UNIT VI

1. UV induced auxotrophic mutant production and isolation of mutants by replica plating techniques.
2. Extraction of cellulase from pathogen (in vitro) and diseased plants (in vivo) and measurement of endoglucanase or carboxymethyl cellulose by reducing sugar determination method / viscometric method.
3. Extraction of pectolytic enzymes from pathogen (in vitro) and diseased plants (in vivo) and assaying of polygalacturonase (PG)/ pectin transeliminases by viscosity method/ TBA (Thiobarbituric method).
4. Screening of disease resistance crop plants with conventional method.
5. Screening of disease resistance crop plants with the help of molecular markers (RAPD/ISSR)
6. Measurement of fungal pathogen genetic diversity by PCR based technique- RAPD/ ISSR markers

Reference Books:

Agrios, G. N. (1997). Plant Pathology, 4th Edn. Academic press, San Diego

Aneja K. R.: Experiments in Microbiology, Plant Pathology and Tissue Culture. Wishwa publishers

Aneja, K. R (2005). Experiments in Microbiology and Plant Pathology and biotechnology. New Age International (P) Ltd. Publishers, New Delhi.

Atwal, A. S. (1936) Agricultural Pest of India and South East Asia. Kalyani Publishers, New Delhi

- Baruah H. K.**, P Brain and A. Baruah, (1984). Textbook of plant pathology. Oxford and IBH Publ. Co., New Delhi.
- Bilgrami K. S.** and **Dube H. C.** (1990).Text book of Modern pathology. Vikas Publishing House Pvt. Ltd. New Delhi.
- Chandrashekharan S. N.** and **S. V. Parthasarthy** (1965). Cytogenetics and Plant Breeding. P. Varadachary and Co. Madras.
- Chatterjee P. B.** (1997). Plant Protection Techniques. Bharti Bhawan. Patana
- Chatterjee, P. B.**(1997) Plant protection techniques. Bharati Bhawan Publishers and Distributors Patna.
- Chattopadhyaya, S. P.** (1987) Principles and Procedures of Plant Protection. Oxford and IBH, New Delhi.
- Dhaliwal, G. S.** and **Arora Ramesh** (1994) Trends in Agricultural Pest Management. Commonwealth Publishers, New Delhi.
- Dickinson M.**(2008). Molecular Plant Pathology. BIOS Scientific Publishers, London and new York.
- Dickison, M. J.** and **J. Beynon** (2000). Annual Plant Reviews,Volume 4-Molecular pant Pathology. Sheffield Academic press,Sheffild.
- Diskson J. C.** (1964) Diseases of Field crop. McGraw –Hill , New Delhi.
- Gerhardson, B** (2002). Biological substitutes for pesticides. *Trends in biotechnology* **20**:338-343. ICAE, Publication.:Crop Diseases Calender
- Jha, L. K.** (1987) Applied Agricultural Entomology. New Central Book Agency, Culcutta.
- Jones D. G.** (1987) Plant pathology – Principles and practices.Opren UniversityPress, Stratford.
- Mehrotra R. S.** and **Ashok Aggarwal** (2005) Plant Pathology. Tata McGrew-Hill publishing Co. Ltd. New Delhi.
- Mehrotra, R. S.** (1980). Plant pathology. Tata McGrew-Hill publishing Co. Ltd. New Delhi.
- Metcalf, C. L.** and **Flint, W. P.** (19830) Destructive and Useful Insects. Tata McGrew-Hill publishing Co. Ltd. New Delhi.
- Nagarajan S.** (1999) Plant Diseases and Epidemiology. Oxford and IBH, New Delhi.
- Nagarajan, S.** and **K. Mualidharan** (1995) Dynamics of Plant Diseases.Allied Publishers, New Delhi .
- Pathak V. N.** (1980) Diseases of Fruit crops. Oxford and IBH, New Delhi.
- Pedigo, L. P.** (1996) Entomology and pest Management. Prentice-Hall Pub. Englewood cliffs NJ
- Punja, Z. K.** (2001). Genetic engineering of plants to enhance resistance to fungal pathogens-a review of progress and future prospects. *Canadian Journal of plant pathology* **23**: 216-235.
- Ramakrishnan T. S.** (1974) Diseases of Millets. ICAR, New Delhi.
- Rangaswami, G.** (1975) Diseases of crop plants in India. Prentice-Hall Pub, New Delhi.
- Rao V. S.**(1987) Principles of Weed Science. Oxford and IBH, New Delhi.
- Rashid S. N.** and **M. M. A. Khan** : Dictionary of Remote Sensing. Manak Publication Pvt. Ltd., New Delhi.
- Roberts D. A.** and **Bothroyd C. W.** (1995) Fundamental Plant Pathology. W. H. Freeman & Co
- Rommens, C. M.** and **G. M. Kishore** (2000). Exploiting the full potential of disease resistance genes for agricultural use. *Current Opinions in Biotechnology* **11**:120-125.
- Saha L. R.** (1990) Hand Book of Plant Protection. Kalyani Publ. New Delhi.
- Saha, L. R.** and **Dhaliwal G. S.** (2006) Handbook of Plant Protection. Kalyani Publ. New Delhi.

- Sambamurty**, A. V. S. S. (2008). Molecular biology. Narosa Publishing House, New Delhi. ISBN 978-81-7319-837-3.
- Schillberg**, S., S. Zimmermann, M. Y. Zhang and R. Fisher (2001). Antibody-based resistance to plant pathogens. *Transgenic research*.**10**:1-12.
- Shrivastava**, V. P. (1988). A Textbook of Applied Entomology. Kalyani Publ. New Delhi
- Sill** Webster H. (1983). Plant Protection. Iowa State Univ.Press
- Singh** Tribhuwan and K. Agarwal (2001). Seed Technology and Seed Pathology, Pointer Publishers, Jaipur-302003 (Raj), India. ISBN 81-7132-284 -0
- Singh**, R. S. (1998) Plant Diseases. Oxford & IBH Publ.
- Singh**, R. S., U. S. Singh, W. M. Hess and D. J. Weber (1988). Experimental and conceptual plant pathology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- Stuiver**, M. H. and J. H. H. V.Custers (2001). Engineering disease resistance in plants. *Nature* **411**: 865-868.
- Suryanaryana**, D. (1974) Seed pathology. Vikas New Delhi
- Tepfer**, M. (2002). Risk assessment of Virus-resistant transgenic plants. *Annual Review of Phytopathology***40**:467-491.

Journals : 1. Crop Protection 2. Geobios 3. Journal of Entomological Society of India.

.....

M. Sc. PART-II (SEMESTER IV)
PAPER-XVI (BO 4.4.9): PLANT DIVERSITY
(SPECIAL PAPER IV) ASSESSMENT OF BIODIVERSITY

Total Lectures: 60

UNIT I:

Methods to study biodiversity: Sampling methods to determine alpha, beta and gamma diversity, methods for floristic diversity, aquatic biodiversity and biodiversity of soil. [8]

Remote sensing to study biodiversity: Concept, definition, principle, technique in brief, types of remote sensing, sensors used in remote sensing, electromagnetic spectrum, remote sensing of vegetation and water. [7]

UNIT II:

Biostatistics: Introduction, applications, ANOVA, use of biostatistics in interpretation of biodiversity data.[4]

Bioinformatics: Introduction, applications, databases (nucleic acid, protein), use of computers and bioinformatics in study of biodiversity. [4]

Biotechnology in conservation of biodiversity: Role of biotechnology in conservation of biodiversity, tools of biotechnology (tissue culture, somatic embryogenesis, synthetic seed technology, cryopreservation, secondary metabolites molecular markers etc.), restoration and species recovery programme. [7]

UNIT III:

Tourism and biodiversity: Eco-tourism, concept, principle, scope of eco-tourism in India, ecocide, sustainable tourism development, public awareness using environmental calendar activities. [8]

Climate change and biodiversity: Global warming and green house effect, causes, effects and remedies, effect of climate change on biodiversity. [7]

UNIT IV:

Molecular tools for biodiversity: Allozymes, molecular markers, RFLP, AFLP, RAPD, PCR, DNA barcoding; Significance of molecular tools in biodiversity. [15]

PLANT DIVERSITY PAPER XV: PRACTICAL COURSE III

UNIT V:

1. Preparation of histogram, polygon, line graph and pie diagram using ANOVA.
- 2-3. Preparation of plant tissue culture media.
4. Propagation of RET Plants using suitable explants by tissue culture method.
5. To study principle and methods of cryopreservation.
6. Gene/ Protein finding from Entrez.

UNIT VI:

1. Isolation of genomic DNA from any plant and qualitative estimation of DNA by Agarose Gel Electrophoresis.
- 2-3. PCR amplification of DNA and southern blotting.
- 4-5. Study of vegetation by diversity indices, method for floristic diversity, Shanon weaver Index.
6. Visit to a Green house and plant tissue culture laboratory and writing a report.

Reference Books:

- Brij Gopal.** and Bhardwaj, N. (1979). Elements of Ecology.
- Galston,** K. J. (1996). Biodiversity: A biology of numbers and differences.
- Greig Smith,** P. (1983). Quantitative Plant Ecology.
- Hamdan,** H. C. and Churchill, E. D. (1961). The Plant Community.
- Hashimoto,** Y. *et al.* (1990). Measurement techniques in plant sciences.
- Henderson** P A 2009 Practical Methods in Ecology; John Wiley and Sons
- Singh** Surendra 1992 Geomorphology and Remote Sensing in Environmental Management; Scientific Publishers
- Chandra** A. M. And **Ghosh** S. K. 2006 Remote Sensing and Geographical Information System; Alpha science
- Ravindran** K.V.1998 Remote Sensing and Geographical Information System for Natural Resource Management; joint publication of Indian Society of Remote Sensing and National Natural Resources Management System, Deptt of Space
- Rastogi** V. B. 2009 Fundamentals of Biostatistics; Ane Books Pvt Ltd.
- Banerjee,** P. K. 2011 Introduction to Biostatistics; S. Chand Limited
- Claverie** J and Notredame C 2011 Bioinformatics for Dummies; John Wiley and Sons
- Sharma J. R.** 1998 Statistical and Biometrical techniques in Plant Breeding New Age International Publishers New Delhi.

Singh J 2010 Ecotourism; I K International Pvt Ltd.

Gupta, P. K. 2010. Plant Biotechnology. Rastogi Publications, Meerut.

Glick, B, R. and Pasternak, J. J. 1994. Molecular Biotechnology- Principles and Applications of Recombinant DNA. ASM Press, Washington D. C.

Gupta, P. K. 2009. Biotechnology and Genomics. Rastogi Publications, Meerut.

Trehan, K. 1994. Biotechnology. Wiley Eastern Limited, New Delhi.

Ramawat, K. G. 2006. Plant Biotechnology. S. Chand and Company Ltd., New Delhi.

Trivedi, P. C. (ed.) 2000. Plant Biotechnology- Recent Advances. Panima Publishing Corporation, New Delhi.

Chawla, H. S. 1998. Biotechnology in Crop Improvement. International Book Distributing Company, Lucknow.

.....

Shivaji University, Kolhapur
M. Sc. (T & D) Botany
Revised Syllabus
Implemented from June, 2014

Marks: 1600

A) THEORY

M. Sc. Part – I

Total Theory Papers 1 to 8 (Eight)
Each paper of 100 marks
Total Theory marks 8 x 100: 800 marks

M.Sc. Part – II

Total Theory Papers 9 to 16 (Eight)
Each paper of 100 marks
Total Theory marks 8 x 100: 800 marks
Total Theory papers for M.Sc. I and II: 16
Total theory marks: 1600 marks
Each Theory paper includes two sections and each section carries 50 marks

B) SEMINARS

Marks: 200

There will be four seminars, each of 50 marks two seminars will be conducted per year.
Total marks for seminar: 200

C) DISSERTATION

Marks: 500

Total marks for Dissertation:500

D) VIVA-VOCE

Total marks for Viva-voce examination:

Marks: 100

Total Examination

M.Sc. Part – I (Theory)	: 800 Marks
M.Sc. Part – II (Theory)	: 800 Marks
Dissertation	: 500 Marks
Viva-Voce	: 100 Marks
Seminar	: 200 Marks

Grand Total	: 2400 Marks

M.Sc. Part-I (Semester - I)

Theory Papers of Regular M. Sc.

Paper1: Prerequisite Course

Paper2: Biology and Diversity of Algae, Fungi and Bryophytes

Paper3: Plant Ecology

Paper4: Biology and Diversity of Pteridophytes, Gymnosperms extant and extinct

M.Sc. Part-I (Semester - II)

Paper5: Cell and Molecular Biology

Paper6: Angiosperm Systematics

Paper7: Plant Pathology

Paper8: Plant structure, Development and Reproduction

M.Sc. (T & D) Botany Part – II Semester-III

Paper 9: Cytogenetics and Crop Improvement

Paper 10: Biotechnology and Genetic Engineering

Any one group of the following

GROUP A-

Paper 11 : Plant Physiology (special paper I) Advanced plant physiology and plant biochemistry

Paper 12 : Plant Physiology (special paper II) Plant growth and development

GROUP B

Paper 11 : Mycology & Plant pathology (special paper I) taxonomy of fungi

Paper 12 : Mycology and Plant Pathology (special paper II) Integrated disease management

GROUP C

Paper 11 : Cytogenetics and Plant breeding (special paper- I) Cytogenetics

Paper 12 : Cytogenetics and Plant Breeding (special paper – II) Plant breeding

GROUP D

Paper 11 : Angiosperm Taxonomy (special paper-I) The evolution and classification of angiosperms

Paper 12: Angiosperm Taxonomy (special paper II) Modern trends in angiosperm taxonomy

GROUP E

Paper 11 : Energy, Ecology & Environment (special paper I) Environment and its aspects

Paper 12 : Energy, Ecology & Environment (special paper II) Population and Community ecology

GROUP F

Paper 11: Marine Botany (special paper I) General marine botany

Paper 12 : Marine Botany (special paper II) Physiology and Biochemistry of marine plants

Group G

Paper 11 : Plant Biotechnology (special paper I) Plant tissue culture

Paper 12 : Plant Biotechnology (special paper II) Molecular Biotechnology and Genetic engineering

GROUP –H

Paper 11 : Plant Protection (special paper I) Crop diseases and their management

Paper 12 : Plant Protection (special paper II) Animate pests of crops and their management

Group- I

Paper 11 : Plant Diversity (special paper I) Introductory biodiversity

Paper 12 : Plant Diversity (special paper II) Conservation of biodiversity

**M.Sc. (T & D) Botany Part – II
Semester-IV**

Paper 13: Plant Physiology and Metabolism

Paper 14: Biodiversity, Conservation and Utilization

Any one group of the following:

GROUP A

Paper 15: Plant Physiology (special paper III) Stress physiology of plants

Paper 16: Plant physiology (special paper IV) Applied plant physiology

GROUP B

Paper 15: Mycology & Plant pathology (special paper III) Industrial mycology

Paper 16: Mycology & Plant pathology (special paper IV) Integrated disease management

GROUP C

Paper 15: Cytogenetics and Plant Breeding (special paper- III) Molecular genetics

Paper 16: Cytogenetics and Plant breeding (special paper IV) Special approaches in genetic improvement of crop plants

GROUP D

Paper 15: Angiosperm Taxonomy (special paper III) Angiosperm taxonomy floristics and biosystematics

Paper 16: Angiosperm Taxonomy (special paper IV) Phylogeny and floral biology of Angiosperms

GROUP E

Paper15 : Energy, Ecology and Environment (special paper III) Experimental ecology and energy studies

Paper16 : Energy, Ecology & Environment (special paper IV) Environmental issues, assessment and restoration

GROUP F

Paper-15: Marine Botany (special paper III) Marine ecology

Paper-16: Marine Botany (special paper IV) Applied Marine Botany

GROUP G

Paper15 : Plant Biotechnology (special paper III) Application and prospects of plant tissue culture

Paper16 : Plant Biotechnology (special paper IV) Application, regulation and patenting biotechnology

GROUP H

Paper15 : Plant Protection (special paper III) Recent trends and techniques in plant protection

Paper 16 : Plant Protection (special paper IV) Molecular plant pathology

GROUP I

Paper15 : Plant Diversity (special paper III) Biodiversity and sustainable development

Paper16 : Plant Diversity (special paper IV) Assessment of biodiversity

DEPARTMENT OF BOTANY
(CHOICE BASED CREDIT SYSTEM)
ELECTIVE I (BO 3.5): PLANT SCIENCES, HUMAN PROGRESS AND PROSPERITY

Total Lectures: 60

Unit-I: Biodiversity and its Conservation	(15)
a) Biodiversity of cryptogams	
1) Biodiversity of Viruses	(1)
2) Biodiversity of Bacteria	(1)
3) Biodiversity of Fungi	(3)
4) Biodiversity of Bryophytes	(1)
5) Biodiversity of Pteridophytes	(1)
b) Biodiversity of Phanerogams	
1) Biodiversity of Gymnosperms	(2)
2) Biodiversity of Angiosperms	(6)
Unit-II: Plant Disease Management	(15)
1) Methods of studying plant disease	(2)
2) Symptoms of plant Diseases	(2)
3) Principles of plant Disease control	(3)
4) Diseases of following crops & their management	(8)
i) Sugarcane ii) Grape iii) Soybean iv) Rose & v) Carnation	
Unit-III: Green house Technology	(15)
1) Glass house, polyhouse, shadehouse, mist chambers and growth chambers	(5)
2) Construction, operation, maintenance and management of greenhouse	(5)
3) Greenhouse environment: watering, fertigation and pest control	(5)
Unit-IV: Horticulture and Gardening	(15)
1) Methods of propagation: Propagation through Seeds, vegetative and micropropagation	(3)
2) Avenue trees, Climbers and lianas, Edgeand hedge plants, Foliage and flowering plants, Bulbous plants, Cycads and palms, Orchids and aquatic plants	(5)
3) Types of gardens, Landscape gardening, Indoor gardening and Kitchen gardening	(5)
4) Wild plants from Western Ghats having ornamental potential	(2)

References:

Gopaldaswamiyengar, K. S., Parthasarathy R. G. and P. Mukadam.1991. Complete Gardening of India. G. Parthaocrruthy, Bangalore

Rangaswami, G, Mahadevan A. 2010: Diseases of crop plants in India. Singh, R. S. 2009: Plant Diseases, 9th Edition.

Handbook of Agriculture. ICAR ,New Delhi.1969.

Nelson, P.V.1973.Greenhouse operation and management. Reston Publishing Co.Inc

DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
ELECTIVE II (BO 4.5): PLANTS- A BIOLOGICAL CAPITAL

Total lectures: 60

Unit-I: Plants, Human and Environment (15)

- 1) Introduction to plants, plant resources and their importance in progress, prosperity and survival of human race (5)
- 2) Plants as key solution for major global problems viz. Energy, pollution control, agricultural productivity, global warming, climate change, soil fertility and conservation etc. (10)

Unit-II: Plants and Industries (15)

- 1) Medicinal plants of India (3)
- 2) Ayurvedic medicines & their industrial formulation (3)
- 3) Fermentation and Cottage Industries (2)
 - a) Ethyl Alcohol Fermentation (2)
 - b) Citric acid Fermentation (2)
 - c) Mushroom Cultivation (5)

Unit-III: Understanding Plant life (15)

- 1) Seed germination, growth & Flowering (4)
- 2) Soil and mineral Nutrition of plants (5)
- 3) Organic farming (2)
- 4) Storage of Agricultural produce (4)
 - a) Fruits b)Vegetables c) Food grains

Unit-IV: Plants and plant products (15)

- 1) Vegetables, oil yielding plants, wild edibleplants, food crops, spices and condiments, Forage- fodder plants (5)
- 2) Fibre yielding plants, textile fibres, cordage fibres, fibres for stuffing (3)
- 3) Important timber yielding plantsand non-wood forest products (2)
- 4) Petro and sericulture crops (1)
- 5) Resin, dye, tannin and gum yielding plants and their applications in industry (2)
- 6) Grasses, their economic importance and human civilization (2)

References

- Jain, S. K.** 2004. A manual of ethnobotany. 2nd edition, Scientific publishers, India.
- Ramanamurthy, G. V.** 1985. Advances in Oilseeds Production and Technology. ICAR, New Delhi
- Gill, N. T. and K. C. Vear and D.J. Barnard.** 1980. Agricultural Botany. 3rd revised edition. Duckworth, London.
- Jha, L.K. and P. K. Sarma.** 1993. Agrofrestry: Indian Perspective. Ashish Publishing House, New Delhi
- Varghese, E.** 1996. Applied Ethnobotany : A case study among the Kharias of Central India. Deep Publications, New Delhi.

- Chapman S. R. and Carter L.P. 1976.** Crop Production: Principles and Practices. Freeman and Company, San Francisco, USA.
- EL Bassam, N.** 1998. Energy Plant Species: Their Use and Impact on Environment and Development. Routledge.
- Aiyer, A. K.** 1966. Field crops of India. Bangalore Printing and Publishing Company, Bangalore.
- Shiva Vandana, V. M. Meherhomji and N.D. Joryal.** 1992. Forest Resources-Crises and Management. Natraj Publishers, Dehradun.
- Jha, L. K. and P. K. Sen Sarma.** 1994. Forestry for the People. Ashish Publishing House, New Delhi.
- Dogra, P.D. and R C. Dhiman (eds.).** 1994. Forestry Research and Education in India. INSA, New Delhi.
- Handbook of Agriculture. 1969. ICAR, New Delhi.
- Wickens, G.E, N. Haq, P.Day (eds.). 1986.** New Crops for Food and Industry. Chapman and Hall, New York

SHIVAJI UNIVERSITY, KOLHAPUR

Department of Botany

**M. Sc.-II [REGULAR (CBCS) and M. Sc. (T & D)]
BOTANY REVISED SYLLABUS
(Choice Based Credit System)**



Implemented from June 2014

DR. S.R.Yadav, M. Sc.
Ph. Professor
and Head,
Department of Botany
Shivaji University,



Phone: Off. (0231) - 2609157
Mobile: 09421102350
Fax: (0231) - 2692333
E-mail:
svadavdu@rediffmail.com

Date: 5-5-2014

To,
The Registrar
Board of in Botany (BOS)
Shivaji University, Kolhapur
Sub: **M. Sc. [Regular (CBCS) and M. Sc. (T & D)] Botany revised syllabus
(Choice Based Credit System) and M. Sc.(T & D)**

Ref: SU/BOS/Sci.10922 dated 4th February, 2014

Botany BOS meeting held on 03-05-2014

Sir,

With reference to above, I am submitting herewith **M. Sc. [Regular (CBCS) and M. Sc. (T & D)] Botany Revised syllabus to be** implemented from June 2014 for your further necessary action.

Similarly I am also submitting a copy of Botany M. Sc. Part-I syllabus which was revised and implemented from June-2013, however there were some typographical mistakes and needed editing which has been incorporated in present copy for which approved may be provided.

.With regards,

Yours sincerely,

S. R. Yadav

Prof. & Head , Dept. of Botany

Encl: 1. M. Sc. Botany (Regular) CBCS syllabus

2. M. Sc. Botany (T & D. Syllabus

3. M. Sc. Botany: Elective-I & II syllabus