

FOLDER-008

बिलासपुर विश्वविद्यालय

बिलासपुर ( छत्तीसगढ़ )



पाठ्यक्रम

विज्ञान - संकाय

नियमन एवं पाठ्यक्रम

एम. एस्. बी. (पूर्व) / ऑलिव

वेन्यू-पॉलि गारल

परीक्षा : 2014

:: प्रकाशक ::

कुलसचिव बिलासपुर विश्वविद्यालय

बिलासपुर ( छत्तीसगढ़ )



## ORDINANCE NO 39

### Master of Science Examination

1. The examination for the degree of Master of Science consist of two parts
  - (A) The Previous examination and
  - (B) The Final Examination.
2. A candidate who after obtaining the degree of Bachelor of science the University or an examination of any statutory University in any statutory University in India which has been recognised by they University as equivalent to B.Sc. degree of the University and has completed a regular course of study in the teaching department of the University in the subject in which he offers himself for examination for one academic year shall be admitted to the previous examination for the degree of master of Science.  
 Provided however every candidate shall offer for the Previous Examination one of the subjects offered by his/her B.Sc. Degree.  
 Provided further (i) for admission of M.Sc. Previous/Final (Botany) and candidate must have offered Maths as one of the subject in B.Sc. (ii) for admission in Previous/Final (Botany) preference will be given to those candidates who offered Maths as one of their subject in B.Sc.
3. A candidate who after passing the M.Sc. previous Examination of the University has completed a regular course of study for one academic year in a teaching department of the University or in a College affiliated to the University shall be admitted to the Final Examination for the degree of Master of Science in the subject in which he/she has passed the Previous examination.  
 A Candidate who has passed the previous examination for the degree of Master of Science of another University may also be admitted to the final Examination for the degree of Master of Science after obtaining necessary permission from the Kulpati, provided that he offered for his previous Examination a course of study of an equivalent standard with almost identical syllabus as is required for the Previous Examination of this University, and has attended a regular course of study for one academic year in a College affiliated to the University teaching department of the University.
4. The examination shall be partly by meant of paper and partly practical including sessional, except in the case of Mathematics where the examination shall be paper only.

- Besides regular students and subject to other compliance with his ordinance, ex-students and non collegiate candidates shall be eligible for admission to the examination as per provision or ordinance No. 6 relating to Examination shall be paper only.
- Provided that non- collegiate candidate shall be permitted to offer only such subjects/papers as are taught to the regular students at any of University teaching Department of College.
6. The Subject of the Examination shall be of the following :
 

(i) Mathematics	(ii) Physics
(iii) Chemistry	(iv) Zoology
(v) Botany	(vi) Geology

A candidate who has passed the M.Sc. Examination of the University shall be allowed to present himself for the M.Com. Examination in any one of more of the optional papers in that subject not taken by him at the said examination and is successful with be given a certificate to that effect.
  7. From the session 1986 - 87 for the Previous Examination, candidate must obtain for a pass atleast 36% in each theory and Practical and 36% of the aggregate marks in the Theory and Practical separately in each examination. The above provision of 20% in each paper shall be applicable for Final Examination from the academic session of 1987-88.
  8. No division will be assigned on the result of the Previous Examination the division in which a candidate is placed shall be determined on the basis of aggregate of marks obtained in both. the M. Sc. Previous and M.Sc. Final Examination.
  9. Successful candidates who obtain 60% or more of the aggregate marks shall be placed in the first Division, those obtaining less than 60% but not less 48% in the second Division and all other successful candidate obtaining less than 48% in the Third Division.
  10. Candidates who gave passed the M.Sc Examination of the University in any subject in Third or Second Division and desire to appear at the M.Sc. Examination in the same subject for improving division without attending a regular course of study in a College affiliated to the University or in a Teaching Department of the University be allowed to appear at the aforesaid examination an non-collegiate student on the following conditions.
    - (i) There shall be only two Division for such candidates the First division and second Division. The Marks required for obtaining these



division shall be the same as prescribed in the ordinance i.e. examinees who are successful in Final of the Examination, and have obtained 60% or more aggregate of the marks in Previous and Final Examination taken together shall be placed in the First Division and Examinees who are successful in Final Examination and have obtained less than 60% but not less than 48% of aggregate marks in previous and Final examination taken together shall be placed in the Second Division.

- (ii) The result of the candidates obtaining less than 48% of the aggregate-marks in previous and Final Examination taken together shall not be declared.

- (iii) Candidates shall have the option to appear at both the previous and final examination in one and the same year and for being successful at the examination, the candidates shall obtain 48% of the aggregate marks.

Provided that such candidates who opt to appear in previous and final examination separately shall have to obtain minimum aggregate required for the previous examination but he will have to obtain at least 48% in the aggregate of previous and final examination taken together or else his result will be cancelled.

- (iv) The syllabus for the examination shall be same as prescribed for the year in which the examination is held.

- (v) Not more than one attempt shall be allowed to such a candidate. Failure of non-appearance at the examination after permission has been accorded by the University shall be counted as an attempt. provided however such candidates who to appear at the previous and final examination separately will be allowed only one attempt of the previous examination and two attempts as the final examination.

- (vi) Candidates who wish to avail the opportunity given in foregoing para will have to apply for permission as required in the Ordinance relating to admission of non-collegiate students to the University examination along with registration fee.

- (vii) In case, a student improves his division under provision of this para, the fresh Degree will be issued after cancelling his first Degree.

## M.Sc. (PREVIOUS) BOTANY 2007-2008

There shall be four theory papers of 100 marks each. There shall be two practical examination of 100 mark each. Practical examination I will be based on paper I, II and Practical examination II will be based on theory Paper III & IV

### PAPER. I. MOLECULAR BIOLOGY, CYTOLOGY & GENETICS

**Cytology:** Outline of the chemical & physical chemical organisation of the cell. Cytoplasmic Organelles (Chloroplast, Mitochondria, Nucleus, Ribosomes) their structure and functions. Morphology & fine structure of chromosome. Structure & numerical changes in chromosome.

**Genetics of Prokaryotes and Eukaryotic Organelles:** Mapping the bacteriophage genome, phage phenotypes genetic recombination in phage, genetic transformation conjugation and transduction in bacteria.

**Gene Structure and Expression -** Genetic fine structure, cis-trans test, fine structure analysis of eukaryotes, introns and their significance, RNA splicing, regulation of gene expression in prokaryotes and eukaryotes.

**Genetic Recombination and Genetic Mapping -** Recombination, independent assortment and crossing over, molecular mechanism of recombination, role of Rec A and Rec B C D enzymes, site-specific recombination, chromosome mapping, linkage groups, genetic markers, construction of molecular maps, correlation of genetic and physical maps. somatic cell genetics, an alternative approach to gene mapping.

**Mutations -** DNA damage and repair mechanisms, inherited human diseases and defects in DNA repair, initiation of cancer at cellular level, proto-oncogenes and oncogenes.

**Molecular Cytogenetics -** Nuclear DNA content, C-value paradox, cot curve and its significance, restriction mapping concept and techniques, multigene families and their evolution, in situ hybridization concept and techniques physical mapping of genes on chromosomes.

#### Suggested Laboratory Exercises -

1. Isolation of mitochondria & the activity of its marker enzymes succinate dehydrogenase (SDH)
2. Isolation of chloroplast and SDS-PAGE profile to proteins of the two subunits of Rubisco.
3. Orcein & Feulgen staining of the salivary gland chromosomes.
4. Induction of polyploidy using colchicine, Different methods & applications.



cations of colchicine.

5. Isolation of Chloroplast mutants using chemical mutagens.
6. Microtomy, smearing for the study & cell divisions.

## PAPER II BIOLOGY AND DIVERSITY OF LOWER PLANTS-CRYPTOGRAMS

8563

~~4543~~ ~~AM-1581~~ ~~AL-6614A-1521~~ MM. 100

**Microbiology** - General account, ultra structure, nutrition and reproduction, biology and economic importance of Bacteria, Cyanobacteria, viruses and mycoplasma.

**Phycology** - General characters habitats, systematic study of range of structure, organisation, reproduction, classification economic importance. Phylogeny and interrelationships of following groups of algae

Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, phaeophyta and Rhodophyta.

**Mycology** - General characters and reproduction of fungi, classification, nutrition and economic importance of fungi, General account of following groups of fungi/Masti/gomycotina, zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.

**Bryophyta** - General characters, structure, distribution, reproduction, classification and life history of following groups of Bryophytes Marchantiales, Jungermanniales, Anthocerotales. Sphagniales, Funariales and polytrichales Maintaining its economic and ecological importance.

**Pteridophyta** - General characters, reproduction, classification of following groups of pteridophytes psilopsida, Lycopsida, sphenopsida, pteropsida and fossil pteridophytes. A special mention must be made about evolution of stele, heterospory and origin of seed habit in pteridoophyta.

## PAPER III. TAXONOMY AND DIVERSITY OF SEED PLANTS

### GYMNOSPERMS

~~4544~~ ~~AL-6615~~ ~~BE67~~ ~~AM-1582~~ MM. 100

**Introduction:** Gymnosperms, the vesselless and fruitless seed plants varying in the structure of their sperms, pollen grains, pollen germination and the complexity of their female gametophyte; evolution of gymnosperms.

A-1522

**Classification of Gymnosperms and their Distribution in India.**

**Brief account of the families of Pteridospermales** (Lyginopteridaceae, Medullosaceae, Caytoniaceae and Glossopteridaceae).

## General Account of Cycadeoidales and Cordaitales

**Structure and reproduction in Cycadales Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales.**

## TAXONOMY OF ANGIOSPERMS

**Origin of intrapopulation variation:** Population and the environment; ecads and ecotypes; evolution and differentiation of species various models.

**The species concept:** Taxonomic hierarchy, species, genus, family and other categories; principles used in assessing relationship, delimitation of taxa and attribution of rank Salient features of the International code of Botanical nomenclature.

**Taxonomic evidence:** Morphology, anatomy, palynology, embryology, cytology; phytochemistry; genome analysis and nucleic acid hybridization.

**Taxonomic tools:** Herbarium: floras; histological, cytological, phytochemical, serological, biochemical and molecular techniques; computers and GIS.

**System of angiosperm classification :** Phenetic versus phylogenetic Systems; cladistics in taxonomy; relative merits and demerits of major Systems of classification; relevance of taxonomy to conservation, sustainable utilization of bio-resources and ecosystem research. **Concepts of phytogeography :** Endemism, hotspots and hottest hotspots; plant explorations; invasions and introductions; local plant diversity and its socioeconomic importance, crop diversity in relation to centres of origin.

### Suggested Readings:

Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International

Pvt. Ltd., New Delhi Cole, A.J. 1969. Numerical Taxonomy, Academic

Press London.

Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy.

Robert E. Kreiger Pub. Co., New York.

Grant, V.1971. Plant Speciation. Columbia University Press, New York.

Grant, W.F. 1984. Plant Biosystematics. Academic Press, London.

Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Hieman Educational Books Ltd., London.



Heslop-Harrison, J. 1967. Plant Taxonomy. English Language Book Soc.

& Edward Arnold Pub. Ltd., UK.

Heywood, V.H. and Moore. O.M. 1984. Current Concepts in Plant Taxonomy.

Academic Press, London.

Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Special. Hieman & Co. Educational Books Ltd., London.

Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition).

McGraw-Hill Book Co., New York.

Nordenstam. B.El Gazaly. G. and Kassas. M. 2000. Plant Systematics for

21st Century. Portlant Press Ltd., London.

Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper & Row Publications, USA.

Singh, H. 1978. Embryology of Gymnosperms. Encyclopaedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.

Solbrig. OT. 1970. Principles and Methods of Plant Biosystematics. The MacMillan co.-Collier-MacMillan Ltd., London.

Solbrig, OT. and Solbrig, D.J. 1979 Population Biology and Evolution. Addison. Wesley Publishing Co. Inc., USA.

Stebbins, G.L. 1974. Flowering Plant- Evolution Above Species Level. Edward Arnold Ltd., London.

Stoce, C.A. 1989. Plant Taxonomy and Biosystematics 2nd edition). Edward

Arnold Ltd. London.

Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.

Woodland, D.W. 1991, Contemporary Plant Systematics, Prentice Hall, New Jersey.

### Suggested Laboratory Exercises:

#### Gymnasperms

1. Comparative study of the anatomy of vegetative and reproductive parts of Cycas, Ginkgo, Cedrus, Abies, Picea, Cupressus, Araucaria, Cryptomeria, Taxodium, Prodocarpus, Agathis, Taxus, Ephedra and Gnetum.

2. Study of important fossil gymnosperms from prepared slides and specimens.

#### Anglasperms

3. Description of a specimen from representative, locally available families.
4. Description of a species based on various specimens to study intraspecific variation: a collective exercise.
5. Description of various species of a genus; location of key characters and preparation of keys at generic level.
6. Location of key characters and use of keys at family level.
7. Field trips within and around the campus; compilation of field note and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
8. Training in using floras and herbaria for identification of specimens described in the class.
9. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
10. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

### PAPER IV. PLANT PHYSIOLOGY AND METABOLISM

~~4545 AM-1583 AL-6616~~ MM. 100

**Energy flow:** Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP. ~~SSC~~

**Fundamentals of enzymology:** General aspects, Allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-menten equation and its significance. A-1523

**Membrane transport and translocation of water and solutes:** Plant water relations, mechanism of water transport through xylem root-microbe interactions in facilitating nutrient uptake, comparison of xylem and phloem transport. phloem loading and unloading, passive and active solute transport membrane transport proteins.

**Signal transduction:** Overview. receptors and G-proteins, phospholipid signaling. role of cyclic nucleotides, calcium-calmodulin cascade. diversity in protein kinases and phosphatases, specific signaling mechanisms. e.g. two-component sensor-regulator system in bacteria and plants, sucrose-sensing mechanism.

**Photochemistry and photosynthesis:** General concepts and historical background. evolution of photosynthetic apparatus, photosynthetic



pigments and light harvesting complexes, photooxidation of water, mechanisms of electron and proton transport, carbon assimilation the calvin cycle, photorespiration and its significance, the C4 cycle, the CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.

**Respiration and lipid metabolism:** Overview of plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids, and their catabolism.

**Nitrogen fixation, nitrogen and sulphur metabolism:** Overview biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation, sulphate uptake, transport and assimilation.

**Sensory photobiology:** History of discovery of phytochromes and cryptochromes, and their photochemical and biochemical properties, photophysiology of light-induced responses, cellular localization, molecular mechanism of action of photomorphogenic receptors, signaling and gene expression.

**Plant growth regulators and elicitors:** Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid, hormone receptors, signal transduction and gene expression.

**The flowering process:** Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development genetic and molecular analysis, role of vernalization.

**Stress physiology:** Plant responses to biotic and abiotic stress mechanisms of biotic and abiotic stress tolerance, HR and SAR, water deficit and drought resistance, salinity stress metal toxicity, freezing and heat stress, oxidative stress.

#### Suggested Readings:

Buchanan, B.B. Gruissem, W. and Jnco, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

Dennis, D.T. Turpin, D.H. Lefebvre, D.D. and Layzell, D.B. (eds) 1997.

Plant Metabolism (Second edition), longman, Essex, En gland.

Galston, A.W. 1989, Life Processes in Plants. Scientific American Library, Springer-verlag, New York USA.

Hooykaas, P.J.J. Hall, M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and molecular Biology of Plant Hormones. Elsevier, Amsterdam, The Netherlands.

Hopkins, W.G. 1995, Introduction to Plant Physiology, John Wiley & Sons., Inc., New York, USA.

Lodish, H. Berk, A., zipursky, S.L. Matsudaira, P. Baltimore, D. and Darmell, J. 2000. Molecular Cell Biology (fourth edition) W.H. Free man and ompny, New York, USA.

Moore, T.C. 1989, Biochemistry and Physiology and Plant of Hormones (second edition) Springer-Verlag, New York, USA.

Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.

Salisbury, F.B. and Rose C.W. 1992. Plant Physiology (4th edition).

Wadsworth Publishing Co., California, USA.

Singhal, G.S. Renger, G., Sopory, S.K. Irrgang, K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.

Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition) Sinauer Associates, Inc., Publishers. Massachusetts. USA.

Thomas, B. and Vince-Pre D. (1997) Photoperiodism in Plants (second. edition) Academic Press, San Diego, USA.

Westhoff, P. (1998) Molecular Plant Development : from Gene to Plant Oxford University Press, Oxford, UK.

#### Suggested Laboratory exercises:

1. Effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. acid phosphatase, nitrate reductase).
2. Effect of substrate concentration on activity of any enzyme and determination of its Km value.
3. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
4. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.
5. To determine the chlorophyll a/chlorophyll b ratio in C3 and C4 plants.
6. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
7. To demonstrate photophosphorylation in intact chloroplasts,



resolve the phosphoproteins by SDS-PAGE and perform autoradiography.

8. Extraction of seed proteins depending upon the solubility
9. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
10. Desalting of proteins by gel filtration chromatography employing Sephadex G25.
11. Preparation of the standard curve of protein (BSA) and estimation of the protein content in extracts of plant material by Lowry's or Bradford's method.
12. Fractionation of proteins using gel filtration chromatography by Sephadex G100 or Sephadex G200.
13. SDS-PAGE for soluble proteins extracted from the given plant materials and comparison of their profile by staining with Coomassie Brilliant Blue or silver nitrate.
14. Separation of isozymes of esterases, peroxidases by native poly acrylamide gel electrophoresis.
15. Radioisotope methodology, autoradiography, instrumentation (GM counter and Scintillation counter) and principles involved.
16. Principles of colorimetry, spectrophotometry and fluorimetry.

#### Suggested Readings (for laboratory exercises)

Bajracharya, D. 1999. Experiments in Plant Physiology : A Laboratory

Manual. Narosa Publishing House, New Delhi.

Cooper, T.G. 1977. Tools in Biochemistry. John Wiley, New York, USA  
Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure,

Mechanism, and Data Analysis VCP Publishers, New York.

Dennison, C. 1999. A Guide to Protein Isolation. Kluwer Academic Publishers Dordrecht. The Netherlands.

Devi, P. 2000. Principles and Methods of Plant Molecular Biology Biochemistry and Genetics. Agrobios, Joonpur, India. Dryer, R.L. and Lata, G.F. 1989. Experimental Biochemistry. Oxford University Press, New York.

Homes, B.D. (Ed.) 1998. Gel Electrophoresis of Proteins: A Practical Approach, 3rd edition. PAS, Oxford University Press, Oxford, U.K.

Harborne, J.O. (1981) Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman & Hall, London.

Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.

Ninfa, A.J. and Ballou, D.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Fitzgerald

Science Press, Inc., Maryland, USA.

Plummer, D.T. 1988. An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

Scott, F.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.

Wilson, K. and Goulding, K.H. (Eds), 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London, UK.

Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.

### M.Sc. (PREVIOUS) BOTANY

#### SCHEME OF PRACTICAL EXAMINATION - 2005-2006

There shall be two practical examinations-

##### PRACTICAL - I

Practical examination will be based on Paper I, II Distribution of marks in practical examination are:

Duration : 6 hours

Allotment of marks : 100

Paper I <sup>st</sup>	30
Paper II <sup>nd</sup>	30
Spots 1 to 5	10
Viva	10
Sessional	20

(to be awarded by the internal examiner at the time of examination)

##### PRACTICAL - II

Practical examination will be based on paper III & IV

Distribution of marks in Practical examination are:

Duration : 6 hours

Allotment of marks : 100

Paper III <sup>rd</sup>	40
Paper IV <sup>th</sup>	30
Spot 1 to 5	10
Viva -	10
Sessional -	20

(to be awarded by the internal examiner at the time of examination).

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**M.Sc. Final Botany****W.E.F. 2007 - 08**

There shall be four theory papers of 100 marks each, paper four will be optional. There shall be two practical, Practicals I will be Based on theory paper I, II, & III of 150 Marks. and practical II and will be based on elective paper IV of 50 Marks.

**M.Sc. Final Botany****Session 2007 - 08 Paper - I****PLANT DEVELOPMENT AND REPRODUCTION**

**Introduction** - Unique features of plant development, Difference between animal and plant development. A-1524

**Seed germination and seedling growth** : Metabolism of nucleic acids, proteins and mobilization of food reserves; Hormonal control of seedling growth - gene expression : use of mutation in understanding development.

**Shoot development** : Organization of the shoot apical meristem (SAM):

Cytological and molecular analysis of SAM: control of cell division and cell to cell communication : control of tissue differentiation especially xylem and phloem: secretory ducts and laticifers: wood development in relation to environmental factors.

**Leaf growth and differentiation** : Determination ; Phyllotaxy; control of leaf form; differentiation of epiderms (with special reference to stomata and trichomes ) and mesophyll II.

**Root development** : Organization of root apical meristem (RAM) : cell fates and lineages - vascular tissue differentiation: lateral root hairs, root - microbe interactions.

**Reproduction**: Vegetative options and sexual reproduction: flower development : genetics of floral organ differentiation. homeotic mutants in Arabidopsis and Antirrhinum; sex determination.

**Male gametophyte** : Structure of anthers; microsporogenesis , role of tapetum; pollen development and gene expression ; male sterility; sperm dimorphism and hybrid seed production; pollen germination, pollen tube growth and guidance. pollen storage ; pollen allergy: pollen embryos.

**Female gametophyte**: Ovule development : megasporogenesis: organization of the embryo sac, structure of the embryo sac cells.

**Pollination, pollen - pistil interaction and fertilization** : Floral characteristics, pollination mechanisms and vectors; breeding system, commercial consideration : structure of the pistil : pollen stigma interactions, sporophytic and gametophytic self-incompatibility

(cytological, biochemical and molecular aspects): double fertilization: in vitro fertilization.

**Seed development and fruit growth** : Endosperm development during early, maturation and desiccation stages; embryogenesis, ultrastructure and nuclear cytology: cell lineages during late embryo developments; storage proteins of endosperm and embryo; polyembryony; apomixis; embryo culture, dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.

**Latent Life - dormancy** : Importance and types of dormancy ; seed dormancy : overcoming seed dormancy: bud dormancy,

**Senescence and programmed cell death (PCD)** : Basic Concepts, types of cell death, PCD in the life cycle of plants, metabolic changes associated with senescence and its regulation; influence of hormones and environmental factors on senescence.

**Suggested Reading.**

Atwell. B. J. Knedermann. P.E. and Jurnbull .C.G.N. (Eds.)1999. plants in action: adaptation in nature performance in cultivation macmillan education, sunday, Australia,

Bewely J.D. and black M. 1994 seeds. Physiology of development and germination plenum press. New York bhojwant. S.S. and Bhatnagar S.P. 2000. The Embryology of angiosperms (4 th revised and enlarged edition) Vikas Publishing house New Delhi.

Burgess. 1985. An introduction to plant cell Development Cambridge University Press, Cambridge.

Fagen K. and Van der pal L. 1979.. The Principles of Pollination Ecology Pergamon press. Oxford.

Fahn A 1982 Plant Anatomy (3rd edition ) Pergamon Press. Oxford.

Fosket. DE 1994 Plant Growth and Development .A Molecular Approach Academic Press San Diego.

Howell. S.H. 1998 Molecular Genetics of Plant Development Cambridge University Press. Cambridge.

Leins. P. Tucker.S.C. and Endress.P.K. 1988 Aspects of Floral Development J.Cramer. Germany.

Lyndon. R.F. 1990 Plant development .The Cellular Basis Univ Cambridge University Press. Cambridge.

Raghavan . V. 1999 Development Biology of Flowering Plants Springer -Verlag New York.

Reven P.H. Evert . R.F. and Echhorn. S.E. 1992 Biology of Plants (5th Edition) Worth New York.

Salisbury, F.B. and Ross, C.W. 1992 Physiology (4th edition) wadsworth Publishing belmont California.



Steevas, T.A. and Sussex, I.M. 1989 Patterns in Plant Development (2nd Edition) Cambridge University Press, Cambridge.

Sedgely, M. and Graffin A.R. 1989 Sexual Reproduction of tree Crop Academic Press. London.

Waisel, Y. Eshel, A. and Kalkaki, U (eds) 1996 Plant Roots: The Hidden Hall (2nd edition) Marcel Dekker. New York.

Shivanna, K.R. and Sawhney, V.K. (eds) 1997 Pollen biotechnology for Crop Production and improvement Cambridge University Press. Cambridge.

Shivanna, K.R. and Sawhney, V.K. (eds) 1997 Pollen Biology : A Laboratory Manual Springer verlag Berlin.

Shivanna, K.R. and Johri, B.M. 1985 The Angiosperm Pollen: Structure and function Wiley Eastern Ltd. New York.

The Plant cell Special Issue on Reproductive Biology of Plants - Vol. 5 (10) 1993 The American Society of Plant Physiologists, Rockville Maryland USA.

### Suggested Laboratory /Field Exercises

1. Effect of gravity unilateral light and plant growth regulators on the growth of young seedlings.
2. Role of dark and red light/far -red light on the expansion of cotyledons and epicotylar hook opening in pea.
3. Study of living shoot apices by dissections using aquatic plants such as Ceratophyllum and Hydrilla.
4. Study in cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double stained permanent slides of a suitable plant such as Cleus Kalaichoe, tobacco Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
5. Study of alternate and distichous, alternate and superposed opposite and superposed opposite and decussate leaf arrangement. Examination of rosette plants (Launaea, Mollugo, Raphanus Hyoscyamus etc.) and induction of boiling under natural conditions as well as by GA treatment.
6. Microscopic examination of vertical sections of leaves such as Cannabis, tobacco, nerium, maize and wheat to understand the internal structure of leaf tissue and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plants.
7. Study of epidermal peels of leaves such as Coccinia, Gaillardia, Tradescantia, Notonea, etc. to study the development and final structure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
8. Study of whole roots in monocots and dicots. Examination of

L.S. of root from a permanent preparation to understand the organization of root apical meristem and its derivatives. (Use Maize, aerial roots of Banyan, Pistia, Jussieuia etc.) Origin of lateral roots. study of leguminous roots with different types of nodules.

9. Study of microsporogenesis and gametogenesis in sections of anthers.

10. Examination of modes of anther dehiscence and collection of pollengrains for microscopic examination (Maize, Grasses, Cannabis, sativa, Croton, Tradescantia, Brassica, Petunia, Solanum melongena, etc.)

11. Tests for pollen viability using stains and in vitro germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.

12. Estimating percentage and average pollen tube length in vitro.

13. Role of transcription and transition inhibitors on pollen germination and pollen tube growth.

14. Pollen storage, pollen pistil interaction, self-incompatibility in vitropollination.

15. Study of ovules in cleared preparations: study of monoporic bisporic and tetraporic types of embryo sac development through examination of permanent stained serial sections.

16. Field study of several types of flower with different pollination mechanisms wind Pollination thrips Pollinations but butterfly pollination, bird Pollination.

### ~~AM-1585~~ Paper - II ~~A1-6618~~ Ecology Resource Utilization & Conservation

MM. 100

~~SCC 1547~~  
**Vegetation Organization:** Concept of community & continuum; analysis of Communities (analytical & synthetic characters); Community coefficients interspecific Association And coordination: concept of ecological niche.

~~A-1525~~  
**Vegetation Development :** Temporal changes (Cyclic and nonCyclic); **Mechanism of Ecological succession** (real floristic & initial floristic composition ; facilitation tolerance & inhibition models.); changes in the Ecosystem properties during Succession.

**Ecosystem Organization:** Structure & function : Primary Production (methods of Measurement, global pattern, controlling factors);

energy dynamics (tropical Organization, energy flow pathways, ecological efficiencies.); Litter fall & Decomposition (Mechanism, substrate quality & climate factors); Global Biochemical cycles of C.N.P & S; mineral cycles (pathways, processes, budgets) In terrestrial & aquatic



ecosystem.

**Air, Water & Soil Pollution:** Kind sources quality parameters: effects on plants & Ecosystems.

**Ecosystem management :** Concept; sustainable development sustainability indicators.

**Origin, evolution, cultivation, & Uses of (1) food - Forage & fodder crops (2) Fibre crops (3) medicinal & aromatic plants & (4) vegetable oil yield crops Importance firewoods & timber yielding plants non wood forest products (NWFPs) Such as bamboos, rattans, raw materials for paper making, gums, tannins, dyes, resins and fruits.**

**Strategies for the conservation - in situ conservation:-** International efforts & Indian initiatives protected areas in India - sanctuaries, national parks, biospheres reserves, wetlands, Mangroves & Coral reefs for conservation of wild biodiversity.

**Strategies for conservation - ex situ conservation :** Principles & practices; Botanical Gardens, fields gene banks, seed banks, in vitro repositories, cryobanks; general Account of the activities of Botanical Survey of India, National Bureau of Genetic Resources, Indian council of Agriculture Research, CSIR & Department of Biotechnology, Non formal conservation efforts.

## PAPER - II

### Suggested Lab, Exercise

1. Determination of mean, variance & standard deviation for the given ecological data.
2. Determination of coefficient of variation of given ecological data.
3. Use of t-test for comparison of the means related to ecological data.
4. To determine minimum size of & number of quadrats required for reliable estimate of the Biomass of grassland.
5. To determine diversity indices (Shannon wiener, concentration of dominance, Species richness, equality and B - diversity) for protected & unprotected grasslands.
6. To estimate the IVI in a grassland using quadrat method.
7. To determine net & gross phytoplankton productivity by light & dark bottle.
8. To estimate dissolved oxygen content in eutrophic & oligotrophic water samples by modified Winkler method.
9. Study of morphology anatomy & microscopic test of stored food materials Viz. wheat Rice Maize Bengal gram, Potato & sugarcane.

10. Study of morphology anatomy & microscopic study of whole fibre using Appropriate viz. cotton.
11. Collection & preparation of herbarium of at least Ten medicinal plants & Ten Aromatic plants.
12. Field Survey prepare a short list of 10 most important sources of fire wood & Timber in your locality.

### Suggested Reading.

- Smith, R.L. 1996 Ecology and field Biology, Harper Collins, New York.
- Muller-Dombois, and Ellenberg, H. 1974, Aims and Methods of Vegetation Ecology, Wiley, New York.
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- Ludwig, J. and Reynolds J.F. 1988. Statistical Ecology. John Wiley & Sons Odums E.P. 1971 Fundamentals of Saunders Philadelphia.
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- Kormondy, E.J. 1996 Concepts of Ecology, Prentice hall of India Pvt Ltd, New Delhi.
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- Chandel K.P.S. Sukla, G and Sharma, N. 1996 Biodiversity in medicinal and aromatic plants in India. Conservation and utilization national bureau of plant genetic resources. New Delhi.
- Chrispeels, M.J. and Sadava, D. 1977 plants food and people W.H. Freeman and co. San Francisco Crista B.R. (ed) 1999. CRC handbook of plant



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- G. and Bairber, E. 1994 plant. Genes and agriculture. Jones and Bartlett publishers Boston.
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- \* Council of scientific & Industrial Research (1948 - 1976). The wealth of India. A Dictionary of Indian Raw Materials and Industrial products New Delhi. Raw Material I - xii, revised Vol I - III (1985 - 1992) Supplement (2000)
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- Heywood, V (Ed) 1995. Global Biodiversity assessment. United Nations. Environment Program Cambridge University Press Cambridge U.K.
- Heywood, V.H. and Wyse Jackson, P.S. (Eds) 1991. Tropical Botanical Gardens. Their Role in Conservation and Development Academic Press San Diego.
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## M.Sc. Final - Paper - III

BIOTECHNOLOGY AND GENETIC ENGINEERING OF  
PLANTS AND MICROBES

AM-1586

A-1526

MM. 100

**Biotechnology :** Basic concepts, principles and scope.

**Plant cell and tissue culture:** General Introduction History, Scope, concept of cellular differentiation, totipotency.

**Organogenesis and adventive embryogenesis :** Fundamental aspects of morphogenesis: somatic embryogenesis and androgenesis, Mechanisms, techniques and utility.

**Somatic Hybridization :** Protoplast isolation, fusion and culture, hybrid selection and regeneration. Possibilities, achievements and limitations of protoplast research.

**Application of Plant tissue culture:** Clonal propagation. Artificial seed, production of hybrids, and somaclones, production of secondary metabolites/ natural products, cryopreservation and germplasm storage.

**Recombinant DNA technology :** Gene cloning principles and techniques, construction of genomic /CDNA Libraries. Choice of vectors, DNA Synthesis and sequencing. polymerase chain reaction DNA finger printing.

**Genetic engineering of plants:** Aims, Strategies for Development of Transgenics (with suitable examples), Agrobacterium - The natural genetic engineer, T - DNA and transposon mediated gene tagging, Chloroplast transformation and its Utility intellectual property Rights, possible ecological risks and ethical concerns.

**Microbial genetic Manipulation:** Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation Technology.

**Genomics and proteomics :** Genetic and Physical mapping of genes, molecular markers for introgression of useful traits, artificial chromosomes, high throughput sequencing, Genome projects. Bioinformatics, functional genomics. Microarrays. Protein, Protein Profiling and its significance.

**Suggested Readings**

Bhojwani S.S and Razdan M.K. 1996 Plant tissue Culture, Theory and Practice (a revised edition) Elsevier Science Publisher, New York, USA.  
Bhojwani S.S. 1990 Plant Tissue Culture: Application and Limitation: Elsevier Science Publishers, New York USA.

Callow, J.A. Ford Lloyd B.V. and Newbury, H.J. 1997 Biotechnology and plant Genetic Resources: Conservation and use CAB international Oxon, UK. Chrispeels, M.J. Sadava, D.E. 1994 Plants Gene and Agriculture Jones & Bartlett Publishers, Boston USA.

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Collins, H.A. and Edwards, S. 1998 Plant cell culture. Bios scientific Publishers. Oxford. UK.

Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology. W.H. Freeman & Company New York USA.

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

Henry S.M. Sopory, S.K. and Veilleux R.E. 1996 in Vitro Haploid production in Higher Plants. Vols. 1.5, Fundamental aspects and Methods Kluwer Academics, Publishers. Dordrecht. The Netherlands.

Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in functional Genomics. Birkhauser Verlag. base Switzerland,

Kartha, K.K. 1985, Cryopreservation of plant calls and Organ CRC Press, Boca Raton, Florida, USA.

Old, R.W. and Primrose, S.B. 1989. Principles of gene Manipulation Blackwell Scientific Publications Oxford UK.

Primrose, S.B. 1995, Principles of Genome Analysis. Blackwell science Ltd. Oxford, UK.

Raghavan, V. 1997, Molecular biology of Flowering Plants. Cambridge University Oxford & IBH Publishing Co. Pvt Ltd. New Delhi.

Raghavan, V. 1986. Embryogenesis in angiosperms : A Developmental and experimental study Cambridge University Press. New York USA.

Shantharam S. and Montgomery J.F. 1999. Biotechnology, Biosafety and Biodiversity Oxford & IBH Publishing Co. Pvt Ltd New Delhi.

Vasil, I.K. and Thorpe T.A. 1994 Plant Cell and Tissue Kluwer Academic Publisher. The Netherlands.

**Suggested Laboratory Exercise.**

1. Growth Characteristic of E. coli using Plating and turbidimetric Methods.
2. Isolation of plasmid from E. coli by Alkaline lysis method and its quantitation spectrophotometrically.
3. Restriction digestion of the plasmid and estimation of the size of various DNA Fragments.
4. Cloning of a DNA fragment in a plasmid vector, transformation of the given bacterial population and selection of recombinants.
5. Demonstration of DNA sequencing by Sanger's dideoxy method.
6. Isolation of protoplasts from various plant tissues and testing their Viability.
7. Effect of Physical (e.g. temperature) and chemical (e.g. osmoticum) factors on protoplast yield.



8. Demonstration of protoplast fusion employing PEG.
9. Organogenesis and somatic embryogenesis using appropriate explants and preparation of artificial seed.
10. Demonstration of androgenesis in *Datura*.
11. Electroporation of protoplast and checking of transient expression of type reporter gene.
12. Co-cultivation of the plant material (e.g. leaf discs) with *Agrobacterium* and study GUS activity Histochemically.

#### Suggested Reading (For laboratory Exercise)

- Butenko, R.G. 2000. Plant Cell Culture. University Press of Pacific.
- Collin H.A. and Edwards S. 1998 Plant Cell Culture Bios scientific Publishers, Oxford UK.
- Dixon R.A. (Ed) 1987 Plant cell Culture: A Practical Approach IRI. press Oxford.
- George, S.B. and Schilperoort. R.A. (Eds) 1994: Plant Molecular Biology. Manual 2nd edition, Kluwer Academic Publishers Dordrecht. The Netherlands.
- George. E.F. 1993, Plant propagation by tissue Culture .Part I The Technology 2nd edition Exegetics Ltd Edington .UK.
- George E.F. 1993 Plant Propagation by Tissue Culture Part 2. in Practice, 2nd edition Exegetics Ltd. Edington, UK.
- Glic B.R. and thompson, J.E. 1993 Methods in Plant Molecular Biology and Biochnology CRC press, Boca raton, Florida.
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- Hall, R.D. (Ed) 1999 Plant cell Culture protocols. humana press, Inc. New Jersy. USA.
- Shaw. C.H. (Ed) 1988 plant Molecular Biology: A Practical Approach IRI. press. Oxford.
- Smith R.H. 2000, Plant Tissue Culture: Techniques and Experiments : Academic Press, New York.

#### PAPER IV (SPECIAL) ELECTIVE PAPER (A) PLANT.

A-1527 PATHOLOGY ~~5569~~

~~4549~~

~~AM-1587~~

~~AL-6620~~

MM. 100

#### History of plant Pathology.

General characteristics of fungi : bacteria and Viruses their heterotrophic behaviour with emphasis on parasitism, parastic ability and virulence.

Symptomatology: General symtoms of plant diseases. Pathogenic or non - pathogenic.

Pathogenicity : Distribution of plant pathogenes, mode of infection, inoculum potential, Kochs postulates.

Host parasite : mechanism of infection, role of enzymes & toxins in relation Pathogenesis.

Defence of plants against pathogens, resistance and suceptibility by para sensitive reaction phytoalexis. Disease syndrome.

#### Effect of environment :

Predisposition & stress, epidemiology and disease forecasting source of infection i.e. seed, soil water or air borne diseases of plants, significance of phyllosphere and Rhizosphere studies Recurrence of disease.

Control of Plant : Principles of plant disease Control, methods of control e.g. regulatory chemical : biological and breeding of resistant varieties of host plants, plants quarantine.

Details of disease cycle Crop lose estimates & recommended control measures for the important diseases caused by fungi bacteria, Viruses, mycoplasma or nematodes, in the following crop plants.

- (a) Wheat, Rice, Bajra, Maize, Sugarcane.
- (b) Arher, Gram, Pea,
- (c) Groundnut, Till, Linseed, Cotton.
- (d) Chillies, Tomato, Potato, Brinjal, Coriander, Tobacco.
- (e) Citrus fruits e.g. Lemon. Orange Musambi, papaya, Apple, banana.



**Books Recommended :**

J.C. Walkar	Plant Pathology
B.B. Mundkar	Fungi and Plant diseases.
G.N. Agrios	Plant Pathology
Wheler	Plant Pathology
Wheler	Plant Pathology
Horsaffil & Dimon	Plant Pathology Vol. 1.3.
Horsfall	Plant Pathology problems & Progress.
K.S. Bilgrami & H.C. Dubey	A Text books of Modern plant Pathology.
R.S. Singh	Plant Pathology
R.S. Singh	Introduction to Principles of plant.
N.G. Rangawami	Plant Disease of crop plants in India.
V.N. Pathak.	Essential of Plant Pathology
Annual Review of Phytopathology	(From 1963) on words.)
Bulter and Jones	Plant Pathology
R.S. Mehrotra	Plant Pathology
Plant Disease Report	(Yearly, Volumes of the U.S. Deptt. of Agriculture)
Grop plant Disease calener	(IARI India).
Silligrami K.S. &	Physiology of Fungi .
R.V. Verma	
Agrawal C.P. &	Micro organism in the laboratory
S.K. Hasija.	
Lilly VG & Barnett HL	Physiology of Fungi.
HL Barnette	Illustrated General of importance of Fungi
Barry, B. Hunter	

**SYLLABUS FOR M.Sc.(FINAL) BOTANY - 2005 - 06****Elective Paper (B)****WEED BIOLOGY****MM.100****INTRODUCTION TO WEEDS :-**

Definition and description of weeds. Worldwide distribution and importance of weeds. Ideal characteristics of weeds. Classification of weeds.

**RELATIONSHIPS AND INTERACTIONS AMONG WEEDS AND CROPS :-**

In agricultural. Forest and range-land systems, Suitability of succession to agriculture, Influence of humans on weed evolution.

**PATTERNS OF EVOLUTIONARY DEVELOPMENT :-**

Concept of 'r' and 'K' selection. weeds as strategists Competitive Ruderals. Stress tolerant competitive tests.

**WEEDS OF DRY HABITATS AND AQUATIC WEEDS :-**

Morphology, reproduction, dispersal, germination and survival of weeds Growth and interference - negative interference : competition. competition and density, methods to study competition. predicting crop loss from competition - Allelopathy.

**MANAGEMENT OF WEEDS :-**

Weeds crop dynamics and management. Impact of weed control on crops. Impact of weed control on weeds. Impact of herbicides. Chemistry of some herbicides. Critical period for control. Aquatic weed management. Biological control of weeds. Weeds thresholds and management.

**PRACTICALS :-****1. Survey of weed - flora of**

- Agricultural ecosystems
- Vegetable orchards
- Roadsides
- Forests

(Identification and preparation of herbaria)

evaluation of seed output and reproductive capacity of some dominant weeds.

Study of a weed plant involving different growth parameters. Measurement of density of weed population.

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Measurement of effect of density on mortality and reproduction of weed species.

6. Measurement of competition : (i) effect of density on competition. (ii) effect of emergence time on competition (iii) effect of expansion rates on competition. (iv) calculation of index of competition.
7. Assessment of responses of herbicides against weeds : (i) preemergence trials. (ii) Postemergence trials.

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