M.Sc. – Botany

Exam.-2017

UNIVERSITY OF KOTA
MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India
Website: uok.ac.in

UNIVERSITY OF KOTA, KOTA
M.Sc. (BOTANY)- Examination – 2017

(M.Sc. Previous)

Paper I	Plant Ecology
Paper II	Cytogenetics
Paper III	Biology & Diversity of Lower Plants : Cryptogams
Paper IV	Taxonomy & Diversity of Seed Plants
Paper V	Plant Physiology and Metabolism
Paper VI	Microbiology and Plant Pathology

(M.Sc.Final)

Paper VII	Plant Development & Reproduction
Paper VIII	Cell and Molecular Biology of Plant
Paper IX	Plant Resource Utilization & Conservation
Paper X	Biotechnology & Genetic Engineering, Plant Breeding & Biometry
Paper XI (a)	Advanced Plant Pathology – I
Paper XII (a)	Advanced Plant Pathology – II
Paper XI (b)	Environmental Biology – I
Paper XII (b)	Arid Zone Ecology – II

Eligibility Criteria for admission in PG course in the subject of Botany – For admission in M.Sc.-(P) Botany, candidate must have passed the Bachelor degree in Science (10+2+3) with Botany as Major Subject.

M.Sc. (BOTANY)- Examination - 2017

(M.Sc. Previous)

Scheme of Examination

There will be six papers in theory, each of three hours duration, 100 marks each and two practicals carrying 150 marks each (10% marks are reserved for viva-voce and 15% for records and 10% marks for seminars in each examination). Each practical examination will be of 6 hours duration to be completed in one day. Student should take the botanical excurssions to be organized local, within or outside of state.

Paper I	Plant Ecology
Paper II	Cytogenetics
Paper III	Biology & Diversity of Lower Plants : Cryptogams
Paper IV	Taxonomy & Diversity of Seed Plants
Paper V	Plant Physiology and Metabolism
Paper VI	Microbiology and Plant Pathology

Paper I – Plant Ecology

Duration : 3 hours **Max. Marks : 100**

Note : The question paper will contain three sections as under –

Section A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10

Section B : 10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50

Section C : 4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks : 40

UNIT – I

Climate, soil and vegetation patterns of the world : Life zones, major biomes, and major vegetation and soil types of the world. Environment – Holistic environment, factors and their interactions, animals and man.

UNIT - II

Vegetation organization : Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, interspecific associations, ordination, concept of ecological niche.

Vegetation development : Temporal changes (cyclic and non-cyclic), mechanism of ecological succession (relay floristic and initial floristic composition, facilitation, tolerance and inhibition models), changes in ecosystem, properties during succession.

UNIT – III

Ecosystem organization : Structure and functions, primary production (methods of measurement, global pattern, comtrolling factors), energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), litter fall and decomposition (mechanism, substrate quality and climatic factors), global biogeochemical cycles of C, N, P and S, mineral cycles (pathways, processes, budgets) in terrestrial and aquatic ecosystems.

Biological diversity : Concept and levels, role of biodiversity in ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns, terrestrial biodiversity hot spots, inventory.

UNIT – IV

Air, water and soil pollution : Kinds, sources, quality parameters, effects on plants and ecosystems.

Climate change : Greenhouse gases (CO_2, CH_4, N_2O, CFCs : sources, trends and role), ozone layer and ozone hole, consequence of climate change (CO_2 utilization, global warming, sea level rise, UV radiation), carbon sequenstration.

UNIT – V

Ecosystem stability : Concept (resistance and resilience), ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems, ecology of plant invasion, environmental impact assessment, ecosystem restoration.

Ecological management : Concepts, sustainable development, sustainability indicators, role of International Union for Conservation of Nature & Natural Resources (IUCN), World Wide Fund for Nature (WWF), UNEP, UNESCO, IGBP etc.

Suggested Readings:

1.Smith, R.L. 1996. Ecology and Field Biology, Harpr Collins, New York
2.Muller-Dombois, D. and Ellenberg, H., 1974. Aims and Methods of Vegetation Ecology, Wiley, New York.
3.Begon, M. Harper, J.L. and Townsend, C.R. 1996. Ecology, Blackwell Science, Cambrodge, U.S.A.
4.Ludwig. J. nad Reynolds, J.F. 1988, Statistical Ecology. John Wiley & Sons.
5.Odum, E.P. 1971. Fundamentals of Ecology, Saunders, Philadelphia.
6.Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
7.Barbour, M.G., Burk, J.H. and Pitts, W.D. 1987. Terrestrial Plant Ecology, Benjamin / Cummings Publication Company, California.
8.Kormondy, E.J., 1996 Concepts of ecology, Prentice- Hall of India Pvt. Ltd., New Delhi.
9.Chapman, E.J. and Reiss, M.J. 1988. Ecology, Principles and Applications, Cambridge University Press, Cambridge, U.K.
10.Molan, B. and Billharz, S. 1997, Sustainability Indicators, John Wily Sons, New York.
11.Treshow, M. 1985. Air Pollution and Plant Life, Wiley Interscience.
12.Heywood V.H. and Watson, R.T. 1985. Global Biodiversity Assessment, Cambridge University Press.
13.Mason, C.F. 1991 Biology of Freshwater Pollution, Longman.
14.Hill, M.K. 1997 Understanding Environmental Pollution, Cambridge University Press.
15.Brady, N.C. 1990 The Nature and Properties of Soils, Macmillan

Suggested Laboratory Exercises :

1. To calculate mean, variance, standard deviation, standard error, cofficient of variation and to use t-test for comparing two means related to ecological data.
2. To prepare ombrothermic diagram for different sites on the basis of given data set and to comment on climate.
3. To find out the relationship between two ecological variables using correlation and regression analysis.
4. To determine minimum size and number of quadrats required for community study.
5. To find out association between important grassland species using chisquare test.
6. To compare protected and unprotected grassland stand using community coefficients (similarity indices).
7. To analyse plant communities using Bra-Curtis ordination method.
8. To determine diversity indices (Shannon – Wiener, concentration of dominance, species richness, equitability and biodiversity) for protected and unprotected grassland stands.
9. To estimate IVI of the species in a woodland using point centered quarter method.
10. To determine gross and net phytoplankton productivity by light and dark bottle method.
11. To determine soil moisture content, porosity and bulk density of soils collected from varying depths at different locations.
12. To determine the Water holding capacity of soils collected from different locations.

13. To determine percent organic carbon and organic matter in the soils of cropland, grassland and forest.
14. To estimate the dissolved oxygen content in eutrophic and oligotrophic water samples by azide modification of Wrinkler's method.
15. To estimate chlorophyll content in SO_2 fumigated and unfumigated plants leaves.
16. To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
17. To study environmental impact of a given developmental activity using checklist as a EIA method.

Paper-II- Cytogenetics

Scheme of Examination Duration 3 Hrs. Max. Marks: 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit short answer in 20 words for each part Total Marks : 10

Section – B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50

Section-C : 4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 question to be attempted Total Marks : 40

Unit-I

Chromatin organization : Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, nucleolus and ribosomal RNA genes, euchromatin and heterochromatin, karyotypes of chromosomes, polytene, lampbrush, B-chromosomes and sex chromosome, molecular basis of chromosome pairing.

Structural and numerical alterations in chromosomes : Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterozygotes, Origin, occurrence, production and meiosis of haploids, aneuploids and euploids, origin and production of autopolyploids, chromosome and chromatid segregation, allopolyploids, types, genome constitution and analysis, evolution of major crop plants, induction and characterization of trisomics and monosomics.

Unit-II

Genetics of prokaryotes and eukaryotic organelles: Mapping the bacteriophage genome, phage phenotypes, genetic recombination in phage, genetic transformation, conjugation and transduction in bacteria, genetics transformation, conjugation and transduction in bacteria, genetics of mitochondria and chloroplasts, cytoplasmic male sterility.

Unit-III

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, Panoply of operon, catabolite repression, attenuation and antitermination.

Genetic recombination and genetic mapping : Recombination, independent assortment and crossing over, molecular mechanism recombination, role of RecA and RecBCD

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 : Spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutation.

Unit-IV

Transposable elements in prokaryotes and eukaryotes, mutation induced by transposons, site-directed mutagenesis, DNA damage and repair mechanisms, inherited diseases and defects in DNA repair, initiation of cancer at cellular level, protooncogenes and oncogenes.

Sex determination, sex linked inheritance, sex limited characters and sex reversal, multiple allele's and blood groups in man.

Cytogenetics of aneuploids and structural heterozygotes : Effect of aneuploidy on phenotype in plants, transmission of monosomics and trisomics and their use in chromosome mapping in diploid and polyploid species, breeding behaviour and genetics of structural heterozygotes, complex translocation heterozygotes, translocation tester sets, Robertsonian translocations, B-A translocations.

Unit – V

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 of chromosomes, computer assisted chromosome analysis, chromosome microdisection and microcloning, flow cytometry and confocal microscopy in karyotype analysis.

Alien gene transfer through chromosome manipulations : Transfer of whole genome, examples from **wheat**, ***Arachis*** and ***Brassica,*** transfer of individual chromosomes and chromosome segments, methods for detecting alien chromatin, production, characterization and utility of alien addition and substitution lines, genetic basis of inbreeding and heterosis, exploitation of hybrid vigour.

Suggested Readings :

1. Albert B. Bray, D., Lewis, J., Raff, M., Robert, K. and Watson, J.D. 1989., Molecular Biology of the Cell (2nd edition), Garland Publishing Inc., New York.
2. Atherly, A.G., Girton, J.R. and McDonald, J.F. 199. The Science of Genetics. Saunders College Publishing, For Worth, USA.
3. Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishiong Co. Minnesota.
4. Busch, H. and Rothblum, J. 1982. Volume X. The Cell Nucleus rDNA Part. A. Academic Press.
5. Hartl, D.L. and Jones, E.W. 1998. Genetics : Principles and Analysis (4th edition). Jones & Bartlett Publishers, Massachusetts. USA.
6. Khush, G.S. 1973. Cytogenetics of Aneuploids. Academic Press, New York, London.
7. Karp, G. 1999. Cell and Molecular Biology : Concepts and Experiments. John Wiley & Sons, Inc., USA.
8. Lewin. B. 2000. Gene VII. Oxford University Press, New York, USA.
9. Lewis, R. 1997. Human Genetics : Concepts and Applications (2nd edition). WCB McGraw Hill, USA.
10. Malacinski, G.M. and Freifeldo, D. 1998 : Essentials of Molecular Bilolgy (3rd edition). Jones and B Artlet Publishers Inc. London.

11. Russel, P.J. 1998. Genetics (5th edition). The Benjamin Cummings Publishing Company INd., USA.
12. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetic (2nd edtition). John Wiley & Sons Inc., USA.

Suggested Laboratory Exercises

1. Linear differentiation of chromosomes through banding techniques, such as G-banding, C-banding and Q-banding.
2. Silver banding for staining nucleolus-organizing region, where 18S and 28srDNA are transcribed.
3. Orecein and Feulgen. Staining of the salivary gland chromosomes of chironomas and Drosophila.
4. Characteristics and behaviour of B chromosomes using maize any other appropriate material.
5. Working out the effect of mono-and tri-somy on plant type, fertility and meiotic behaviour.
6. Induction of polyploidy using colchicines, different methods of the application of Colchicines.
7. Effect of induced and spontaneous polyploidy on plant phenotype, meiosis, pollen and seed fertility and fruit set.
8. Effect of translocation heterozygosity on plant phenotype. Chromosome pairing and chromosome disjunction and pollen and seed fertility.
9. Meiosis of complex translocation heterozygotes.
10. Isolation of chlorophyll mutants, following irradiation and treatment with chemical mutagens.
11. Estimation of nuclear DNA content through microdensitomerty and flow cytometry.
12. Fractionation and estimation of repetitive and unique DNA sequences in nuclear DNA.

Suggested Readings :

1. Fukui K. and Nakayama, S, 1996. Plant chromosomes : Laboratory methods. CRC Press, Boca rattan, Florida.
2. Sharma, A.K. and Sharma, A. 1999. Plant chromosome Analysis. Manipulation and Engineering. Hoarwood Academic publisher. Austraila.

Paper-III : Biology and Diversity of Lower Plants: Cryptogams

Scheme of Examination

Duration 3 Hrs. Max. Marks: 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions. 2 questions from each unit. 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit -I

Phycology : Algae in diversified habitats (terrestrial, freshwater, marine) thallus organization, cell ultrastructure, reproduction (vegetative, asexual, sexual) criteria for classification of algae; pigments, reserve food, flagella, modern classification. Salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta. Phaeophyta and Rhodophyta, with special reference to Microcystis, Hydrodictyon, Drapernaldiopsis, Cosmarium, algal blooms, algal biofertilizers: algae as food, feed and use in industry.

Unit-II

Mycology : General character of fungi, substrate relationship in fungi, cell ultrastructure, unicellular and multicellular organization, cell wall compsition, nutrition (sapropili, biotrophic, symbiotic), heterothallism, heterokaryosis, parasexuality, recent trends in classification, phylogeny of fungi.

Unit-III

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina, with special reference to Pilobolus, Chaetomium, Morchella, Melampsora, Polyporus, Drechslera & Phoma, fungi in industry medicine and as food, Mycorrhizae, fungi as biocontrol agents.

Unit-IV

Bryophyta : Morphology, structure, reproduction and life history, distribution, classification, general account of Sphaerocarpales. Sphaerocarpales- Sphaerocarpos Junger maniales-Porella, Anthocesothles-Notothyllas, Sphagnales-Sphagnum, Polytrichales-Pogonatum. Economic and ecological importance.

Unit-V

Pteriodophyta : Morphology, anatomy and reproduction, classification; evolution of stele; heterospory and origin of seed habit; general account of fossil pteriodophyta; introduction to Psilplosida, Lycopsida, Sphenopsida and Pteropsida; with special reference to *Lycopodium, Gleichenia, Pteris, Isoetes & Ophioglossum.*

Suggested Reading

Alexopoulus, C.J., Mims. C.W. and Blackwel, M. 1996. Introductory Mycology, John Wiley & Sons Ind.

Cliftron, A. 1958. Introduction to the Bacteria. McGiaw-Hill Book Co., New York.

Kumar, H.D; 1988. Introductory to Plant Viruses. Chand & Co. Ltd., Delhi

Mandahar, C.L. 1978. Introduction to Plant Viruses. Chand & Co. Ltd. Delhi.

Mehrotra, R.S. and Aneja, R.S. 1998. An Introduction to Mycology, New Age Intermediate Press.

Morris, I.1986. An Introduction to the Algae. Cambridge University Press, U.K.

Parihar, N.S. 1991. Broyophyta. Central Book Depot, Allahabad Parihar, N.S. 1996. Biology & Morphology of Pteridophytes. Central Book Depot, Allahabad.

Puri, P. 1980, Bryophytes. Atma Ram & Sons, Delhi.

Rangaswamy, G. and Mahadevn, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi.

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

Sporne, K.K. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd. Mumbai.

Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants, Cambridge University Press.

Suggested Laboratory Exercises

Morphological study of representative members of algae, fungi, bacteria, bryophytes and peridophytes : *Microcystis,Aulosira, Oocysits, Pediastrum, Hydrodictyon, Ulva, Pithophora, Stigeoclonium, Draparnaldiopsis. Closterium, Cosmarium, Chara, Stemonitis, Peronospora, Albugo, Mucor, Pilobolus, Yeast, Emericella, Chaetomium, Pleospora, Morchella, Melampsora, Phallus, Polyporus, Drechsiera, Phoma, Penicillium, Aspergillus, Colletotrichum, Plagiochasma, Asterella, Notothylas Polytrichum, Psilotum, Lycopodium, Selaginella, Equisetum, Gleichenia, Pteris, Ophioglossum, Isoetes.*

Symptomology of some diseased specimens: White rust, downy mildew, powdery mildew, rusts, smuts, ergot, groundnut leaf spot, red rot of sugarcane, wilts, paddy blast, citrus canker, bacterial blight of paddy, angular leaf spot of cotton, tobacco mosaic, little leaf brinjal, sesame phyllody, mango malformation.

Study of morphology, anatomy and reproductive structures of bryophytes and pteridophytes.

Gram staining of bacteria.

Identification of fungal cultures : *Rhizopus, Mucor, Aspergillus, Penicillium, Emericella, Chaetomium, Drechslera, Curvularia, Fusarium, Phoma, Colletotrichum, Graphium.*

Paper-IV : Taxonomy and Diversity of Seed Plants

Scheme of Examination

Duration 3 Hrs. Max. Marks: 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions. 2 questions from each unit. 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

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. Classification of Gymnosperms and their Distribution in India. Economic Importance of Gymnosperms.

Brief account of the families of Pteridospermales (Lyginopteridaceae, Meudullosaceae, Caytoniaceae and Glossopteridaceae)

General Account of Cycadeoidales and Cordaitales.

Structure and reproduction in Cycadales, Ginkgoales *(Ginkgo),* Coniferales, Welwitschiales *(Welwitschia*) and Gnetales *(Gnetum).*

Unit-II

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.

Unit-III

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.

Systems of angiosperm classification : Phenetic versus phylogenetic systems, cladistics in taxonomy, relative merits and demerits of major systems of classification, relevance of taxonomy to conservation.

Unit-IV

Concepts of phytogeography:Endemism, hotspots and hottest hotspots, plant explorations, invasions and introductions, local plant diversity and its socio-economic importance. Sustainable utilization of bioresources.

Unit-V

Phylogeny of Angiosperms : Ancestors of Angiosperms, time and place of origin of Angiospersms, Habit of Angiosperm, Primitive living Angiosperms, Interrelationship among the major groups of Angiosperms.

Suggested Reading

1. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi.
2. Cole, A.J. 1969. Numerical Taxonomy, Academic Press, London.
3. Devis, P.H. and Heywood, V.H. 1973, Principles of Angiosperms Taxonomy, Robert E. Kreiger Publ Co., New York.
4. Grant, V. 1971. Plant Speciation. Columbia University Press, New York.
5. Grant, W.E. 1984. Plant Biosystematics. Academic Press, London.
6. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London.

7. Heslop-Harrison, J. 1967. Plant Taxonomy, English Language Book Soc. & Edward Arnold Pub. Ltd. U.K.
8. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
9. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hiemand & Co. Educational Books Ltd. London.
10. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-Hill Book Co., New York.
11. Nordenstam, B., El Gazaly, G., and Kassas, M. 2000. Plant Systematics for 21st Century. Portland Press Ltd. London.
12. Radford. A.H. 1986, Fundamentals of Plant Systematics. Harper & Row Publications, USA.
13. Singh, M. 1978, Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
14. Solbrig, O.T. 1970. Principals and Methods of Plant Biosystematics. The Macmillan Co-collier-MacMillan Ltd. London.
15. Solbrig, O.T. and Solbrig, D.J. 1979. Population Biology and Evolution, Addison-Weslley Publicating Co. Ind. USA.
16. Stebbings, G.L. 1974, Flowering Plant-Evolution Above Species Level. Edward Arnold Ltd. London.
17. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition) Edward, Arnold Ltd. London.
18. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
19. Woodland, D.W. 1991, Contemporary Plant Systematics. Prentice Hall. New Jersey.

Suggested Laboratory Exercises

1. Comparative study of the anatomy of vegetative and reproductive parts of Cycas, Ginkgo, Cedrus, Abies, Picea, Cupressus, Araucaria, Cryptomeria, Taxodium; Pedocarpus, Agathis, Taxus, Ephedra and Gnetum.
2. Study of important fossil gymnosperms from prepared slide and specimens, Angiosperms.
3. Description of a specimen from representative, locally available families.

List of Locally Available Families :

(1) Ranunculaceae, (2) Capparidaceae, (3) Portulacaceae, (4) Caryophyllaceae, (5) Malvaceae, (6) Tiliaceae, (7) Streculiaceae, (8) Zygophyllaceae, (9) Rhamnaceae, (10) Sapindaceae, (11) Leguminosae, (12) Combretaceae, (13) Myrtaceae, (14) Cucurbitaceae, (15) Umbelliferae-Apiaceae, (16) Rubiaceae, (17) Asteraceae, (18) Primulaceae, (19) Plumbaginaceae, (20) Asclepiadaceae, (21) Convolvulaceae, (22) Solanaceae, (23) Boraginaceae, (24) Polemoniaceae, (25) Acanthaceae, (26) Pedaliaceae, (27) Martyniaceae, (28) Bignoniaceae, (29) Lamiaceae, (20) Nyctaginaceae, (31) Polygonaceae, (32) Chenopodiaceae, (33) Amaranthaceae, (34) Aizoaceae, (35) Mollugmaceae, (36) Euphorbiaceae, (37) Commelinaceae, and (38) Cyperaceae.

4. Description of species based on various specimens to study intraspecific vartation : 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 key at family level.
7. Field trips within and around the campus, compilation of field notes and preparation of herbarium sheets of such plants, natural 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-V : Plant Physiology and Metabolism

Scheme of Examination

Duration 3 Hrs. Max. Marks: 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions. 2 questions from each unit. 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit -I

Water relation of plants : Unique physico chemical properties of water, chemical potential, water potential, apparent free space, bulk movement of water, Soil Plant Atmosphere Continuum (SPAC), stomatal regualtion of transpiration, signal transduction in guard cell.

Membrane Transport : Passive-non-mediated transport and Ernst equation, Passive-mediated transport, ATP-driven active transport, Uniport, Symport, Antiport, Ion channels.

Amino acids, Proteins and Enzymes : Nod factor, root nodulation and nitrogen fixation, structure of amino acids, stereo-monomers, Amphoteric properties, synthesis of amino acids by reductive amination, GS-GOGAT system and transamination.

Unit-II

Structure of proteins : Primary, secondary, tertiary, quaternary domain structure, reverse turn and Ramchandran Plot. Protein ability : electrostatic forces, hydrogen bonding, disulfide bonding hydrophobic interaction.

Enzymes : Structure and properties, substrate specificity, classification and mechanism of enzyme action.

Carbohydrates : Classification, structure and function of monosaccharides, polysaccharides and glycoproteins including starch, cellulose and pectins.

Unit-III

Photosynthesis : Photosynthetic pigments, absorption and transformation of radiant energy, photo-oxidation, four complexes of thylakoid membranes :photosystem I, cytochrome b-f complex photosystem II and coupling factors, photolysis of water and C_4 evolution, non-cyclic and cyclic transportation of electrons, water cycle, proton gradient and photophosphorylation, Calvin cycle regulation of RUBISCO activity, control of Calvin cycles. C^4 pathway and its adaptive significance, CAM pathway, differences between C^3 and C^4 plants. Glycolate pathway and photorespiration chlororespiration and CO_2 concentrating mechanism in micro-organism.

Unit-IV

Respiration : Anaerobic and aerobic respiration, amphibolic nature of TCA cycle, pentose phosphate pathway, glyoxylate pathway, oxidative phosphorylation, gluconeogenesis, high energy compounds : their synthesis and utilization.

Fat metabolism : Synthesis of long chain fatty acids, lipid biosynthesis, and oxidation.

Secondary metabolites : Biosynthesis and function of secondary metabolites with special reterence to tannins, alkaloids and steroids.

Unit-V

Plant growth regulators : Auxins-chemical nature, bioassay physiological effects and mode of action.

Gibberellins : chemical nature, bioassay, physiological effect and mode of action.

Cytokinins-chemical nature, bioassay, physiological effects and mode of action.

Abscisic acid : chemical nature, bioassay, physiological effect and mode of action.

Physiology of flowering : Photoperiodism and vernalization.

Suggested Reading :

1 Bachanan, B.B. Gruissim, W. a2nd lones, R.L. 2000, Biochemistry and Molecular Biology of Plants. American Society Plant physiologists, Maryland, USA.
2. Dennis, D.T. Turpin, D.H. Lefebvre, D.D. and Layzell, D. (Eds) 1997. Plant Metabolism (second edition). Longman sex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American, Springer-Verlag. New York, USA.
4. Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elservier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6. Lodish, II., Berk, A., Zipursky, S.L., Matsudaira P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (fourth edition). W.M. Freeman and Company, New York USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. (second edition). Springer-Verlag, New York, USA
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S. Renger, G., Sopory. S.K., Irrgang, K.D. and Govindjle 1999., Concepts in Photobiology : Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
11. Taiz. I., and Zeiger, E., 1998. Plant Physiology (2nd edition) Sinaucr Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Preu, D. (1997) Photoperiodism in Plants (second edition). Academic Press, San Diego, USA.
13. Westhoff, P. (1998) Molecular Plant Development from Gent to Plant, Oxford University Press, Oxford, U.K.

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 on 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 C_3 and C_4 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 succenate dehydrogenase activity, its kinetics and sensitivity to inmcitors.
10. Desalting of proteins by gel filtration chromatography employing Sepnadex.
11. Preparation of the standard curve of protein (BSA) and estimation of the protein content in extracts of plant material by Lowry or Bradford's methold.
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 Briliant Blue or silver nitrate.
14. Separation of isozymes of esterases, peroxidases by native polyacrylamide gel electrophoresis.
15. Radioisotope methodology, autoradiography, instrumentation (GM count and Scintillation counter) and principles involve.
16. Principles of colorimetry, spectrophotometry and fluorimetry.

Suggested Reading (for laboratory exercise)

1. Bajracharya, D. 1999. Experiments in Plant Physiology Laboratory Manual, Narosa Publishing House, New York, USA.
2. Cooper, T.G. 1977. Tools in Biochemistry. John W. New York, USA
3. Copeland, R.A. 1996. Enzymes : A Practical intr Structure, Mechanism and Data Analysis. VCH Publishing House, New York, USA.
4. Dennison, C. 1999. A Guide to Protein Isolation. Demic Publishers, Dordrecht. The Netherlands.
5. Devi, P. 2000. Principles and Methods of Plant Molecular Biology. Biochemistry and Geneties. Agroblors, Jodhpur, India.
6. Dryer. R.L. and Lata, G.F. 1989. Experimental Biochemistry Oxford University Press, U.K.
7. Haines B.D. (Ed.) 1998. Gel Electrophoresis of Proteins, Practical Approach, 3rd edition. PAS, Oxford University Press, U.K.
8. Harbome, T.C. 1981. Phytochemical Methods : A Guide Modern Techniques of Plant Analysis. Chapman & Hall, don.
9. Moore, T.C. 1974. Research Experiences in Plant Physiology : A Laboratory Manual, Springer-Verlag, Berlin.
10. Ninfa, A.J. and Ballou, D.P. 1998 Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Fitzgerald Science Press, Inc. Maryland, USA.
11. Piummer, D.T. 1998. An Introduction to Practical Biochemistry. Tata MCGraw-Hill-Publishing Co. Ltd, New Delhi.
12. Scott, R.P.W. 1995. Techniques and Practice of Chromatography. Marcel DcKkker, Inc. New Delhi.
13. Wilson, K. and Goulding, K.H. (Eds) 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London, UK.
14. Wilson, K and Walker, J. 1994. Practical Biochemistry : Principles and Techniques. 4th edition, Combridge University Press Cambridge, U.K.

Paper-VI : Microbiology and Plant Pathology

Scheme of Examination

Duration 3 Hrs. Max. Marks: 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions. 2 questions from each unit. 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

Important landmarks in the history of microbiology arch-aebacteria and eubacteria : General account, ultrastructure, nutrition and reproduction, biology and economic importance, cyanobacteria-salient features and biological importance.

Viruses : Classification, characteristics and ultrastructure of isolation and purification of viruses, chemical nature, replication, transmission of viruses, cyanophages, economic importance.

Phytoplasma : General characteristics and role in causing plant diseases.

Unit-II

Scope and application of microbes in agriculture, industry, pollution and biological control of pests.

General account of immunity, allergy, properties of antigens antibodies. Antibody structure and function, affinity and anti body specificity. Monoclonal antibodies and their uses, antibody

engineering, serology, types of vaccines. Preliminary account of Biofilms, biochips, biosensors and biosurfactants.

Unit-III

History and scope of plant pathology : General account of diseases caused by plant pathogens. Pathogen attack and defense mechanisms Physical, physiological, biochemical and molecular aspects.

Plant disease management : Chemical, biological, IPM systems, development of transgenics, biopesticides, plant disease clinics.

Unit-IV

Symptomology, identification and management of following plant diseases.
Fungal diseases : Wheat (Rust, Smut, Bunt), Bajra (Greenear, ergot and smut), crucifer (Rust). Paddy (Paddy blast), Cotton (Wilt), Grapes (Downy mildew and powdery mildew).

Unit-V

Preliminary account of application of Biotechnology in plant pathology.
Bacterial disease : Wheat (Tundu), Soft rot of vegetables.
Viral disease : Tobacco mosaic, Bhindi yellow mosaic.
Phytoplasma disease : Little leaf of brinjal.
Nematode disease : Root-knot of vegetables.

Suggested Reading

1. Alexopoulus, C.J., Minis, C.W. and Blackwel, M. 1996 Introductory Mycology. John Wiley & Sons Inc.
2. Agrios, G.N. 1997. Plant Pathology. Academic Press, London.
3. Albajes, R., Cullino, M.L., Van Lenteren, J.C. and Elad, 2000 Integrated Pest and Disease Management in Greenhot Crops. Kiluwel Academic Publishers.
4. Bridge, P. Moore, D.R. & Scotf, P.R. 1998. Information Technology. Plant Pathology and Biodiversity. CAB International, U.K.
5. Clifiton, A. 1958. Introduction to the Bacteria. McGraw Book Co., New York.
6. Mandahar, C.I. 1978. Introduction to plant viruses. Chan Co. Ltd. Delhi.
7. Mehrotar R.S. Plant Pathology. Tata McGraw Hill.
8. Rangaswamy, G. & Mahadevan, A. 1999. Diseases of crop plants in India (4th edition) Prentice Hall of India, Pvt. New Delhi. Horsfall, J.G. & A.L. Dimond. Plant Pathology Vols. 1, 2 & 3. Academic Press, New York, USA.
9. Trivedi, P.C. 1998. Nematode Diseases in Plants, CBS Publisher & Distributor, New Dehli.

Suggested Laboratory Exercises (Microbiology)

1. Calibration of microscope : determination of dimensions of micro-organisms (suggested model organisms : yeast, lactobacilli, cyanobacteria)
2. Cultivation media of autotrophic and heterotrophic micro-organisms (cleaning of glasswares, mineral media, complex media, solid media, sterilization)
3. Isolation of microorganisms, streaking on agar plates/pour plate method, isolation of clones, preservation
4. Determination of growth of a microorganism (model organism : Escherichia coli, effects of nutrients, e.g. glucose, fructose, sucrose, principle of colorimerty/spectrocolorimeter)
5. Determination of microbial population size (suggested model organism yeast, use of haemocytometer, serial dilution techniques, relationship between dilution and cell count, determination of standard error, reliability in cell counts)
6. Preparation of Winogradsky column using pond bottom mud. Observations on temporal sequence of appearance of microbes (visual appearance, microscopic, observations)
7. Observation on virus infected plants (symptoms)
8. Fermentation by yeast (inverted tube method, use of different substrates, e.g. glucose, fructose, cane sugar, starch)

M.Sc. (Previous) – Botany
Skeleton Paper -I

Time : 6 hrs **M.Marks: 150**

Q1. a. To determine the Frequency /Density/Species Cover by quadrat method diagram. **12**

b. To determine the moisture content of soil/pH of given sample. **05**

Q2. Identify the various stages of cell division / measure the pollen size through micrometry. **10**

Q3. Identify the material present in the mixture A, draw a labeled diagram and comment upon their significant characteristics and systematics. **10**

Q4. Make a suitable preparation of material B so as to show reproductive part of the given plant. **10**

Q5. Make a suitable preparation of vegetative and reproductive part of material C, draw labeled sketches, write features of special interest and identify with reasons. **15**

Q6. Make a suitable preparation of vegetative and reproductive part of material D, draw labeled sketches, write features of special interest and identify with reasons. **15**

Q7. Spots. (3x6) = **18**

Q8. Record **25**

Q9. Sessional **15**

Q10. Viva-Voce **15**

M.Sc. (Previous) – Botany

Skeleton Paper-II

Time : 6 hrs **M. Marks: 150**

Q1. a. Describe the given material in semi-technical language, assign it to the relevant family with reasons, draw floral diagram. (A) **15**

b. Prepare an artificial key of given plant materials (B,C) / Determine % similarly co-efficient among different plant species and prepare phaenogram. **05**

Q2. a. Make a suitable preparation of material D(veg. Part only), draw labeled diagram and identify with reasons. Write points of special interest. **10**

b. Make a suitable preparation of material E (reproductive parts only), draw labeled diagram and identify with reasons. **10**

Q3. Perform the Physiological experiment, describe the methodology, record your observations and conclusion. (i) Exercise A (major) (ii) Exercise B (minor) **20**

Q4. (i) Perform the microbiological exercise F. Draw suitable diagram, describe methodology and record observations.

a. Gram staining **05**
b. Isolation of bacteria / Yeast fermentation **07**

(ii) Prepare a suitable slide of given material G. For histological study – draw labeled diagram and identify the pathogen giving reasons. **10**

Q5. Spotting 6x3= **18**

Q6. Herbarium & Record **20**

Q7. Sessional Marks **15**

Q8. Viva-Voce **15**

M.Sc (F)- Botany Examination – 2017

Scheme of Examination

There will be six papers, four compulsory and two elective, in theory of 3 hours duration carrying 100 marks each and two practical such as follows :

1. Practical for compulsory papers of 200 marks of 8 hours duration to be completed in one day.
2. Practical for elective papers – 100 marks of 4 hours duration to be completed in one day.
3. 10% marks are reserved for viva-voce, 15% for record and 10% marks for seminar in each practical examination.

Each theory paper will have 15 questions, out of which a student has to attempt 8 questions and the question No.1 will be compulsory. The question No.-1 will carry 10 marks and will be of several short objective type of questions such as multiple choice type, one line answer type, one word type, fill in the blanks type.

Paper VII	Plant Development & Reproduction
Paper VIII	Cell and Molecular Biology of Plant
Paper IX	Plant Resource Utilization & Conservation
Paper X	Biotechnology & Genetic Engineering, Plant Breeding & Biometry
Paper XI (a)	Advanced Plant Pathology – I
Paper XII (a)	Advanced Plant Pathology – II
Paper XI (b)	Environmental Biology – I
Paper XII (b)	Arid Zone Ecology – II

M.Sc. (F) Botany Examination- 2017

Paper VII : Plant Development and Reproduction

Scheme of Examination **Duration : 3 hours** **Max. Marks : 100**

Note : The question paper will contain three sections as under –

Section A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10

Section B : 10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50

Section C : 4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words,2 questions to be attempted. Total Marks : 40

UNIT – I

Introduction : Unique features of plant development, differences between animal and plant development.

Seed germination and seedling growth : Metabolism of nucleic acids, proteins and mobilization of food reserves, tropisms, hormonal control of seedling growth, gene expression, use of mutants in understanding seedling development.

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

UNIT – II

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 epidermis (with special reference to stomata and trichomes) and mesophyll.

UNIT – III

Reproduction : Vegetative and sexual reproduction, flower development, genetics of floral organ differentiation, homeotic mutants in *Arabidopsis* and *Antirhinum*, 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¸ megasporogeneis, organization of the embryo sac, structure of the embryo sac cells.

UNIT – IV

Pollination, pollen-pistil interaction and fertilization : Floral characteristics, pollination mechanisms and vectors, breeding systems, commercial considerations, structure of the pistil, pollen-stigma interactions, sporophytic and gametophytic self incompatibility (cytological, biochemical and molecular aspects), double fertilizatiom, in-vitro fertilization.

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

UNIT – V

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 of senescence.

Suggested Readings

1. Atwll, B.J. Kriedcrmann, P.E. and Jumbull, C.G.N. (eds). 1999. Plants in Action : Adaption in Nature Performance, in Cultivation, MacMillan Education. Sydney, Australia.
2. Bewley. J.D. and Black, M. 1994. Seeds: Physiology of Development and Germination, Plenum Press. New York.
3. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Deihi.
4. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
5. Fageri, K. and Van der Pijl, L. 1979. The Principle of Pollination Ecology. Pergamon Press, Oxford.
6. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.
7. Fosker, D.E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego.
8. Howell, S.H. 1998. Molecular Genetics of Plant Developmem. Cambridge University press, Cambridge.
9. Leins, P., TucKer, S.C. and Endress, P.K. 1988. Aspects of Floral Development, J. Cramer, Germany.
10. Lyndon, R.F. 1990. Plant Development. The Cellular Basis, Unnin Byman, London.
11. Murphy, T.M. and Thompson, W.E, 1988. Molecular Plant Development. Prentice Hall, New Jersey.
12. Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
13. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
14. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
15. Raven, P.H., Evrt, R.F. and Eichhorn, S. 1992. Biology of Plants (5th edition). Worth, New York.

16. Salisbury, P.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing, Belmont, California.
17. Steeves, T.A. and Sussex, I.M., 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
18. Sdgely, M. and Griffin, A.R. 1989. Sexual Reproduction to Tree Crops. Academic Press, London.
19. Waisel, Y., Eshel, A. and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden Hall (2nd edition). Marcel Dekker, New York.
20. Shivanna, K.R. and Sawhney, VK. (eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge.
21. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology : A Laboratory Manual. Springer-Verlag. Berlin.
22. Shivanna, K.R. and Johri, B.M. 19R5. The Angiosperm Polien : Structure and Function. Wiley Eastern Ltd.. New York.
23. The Plant Cell Special Issue on Reproductive Bilogy 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 of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus, Kalanchoe, 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 bolting 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 tissues and trichomes, glands etc. Also study the C_3 and C_4 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. Examinatian 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*, *Jussieua* 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. Examinatian of modes of anther dehiscence and collection of pollen grains for microscopic examination (maize, grasses, *Cannabis sativa, Crotoloria, 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 translation inhibitors on pollen germination and pallen tube growth.
14. Pollen storage, pollen-pistil interaction, self-incompatibility, in vitro pollination.
15. Study of ovules in cleared preparations, study of monosporic, bisporic and tetrasporic types of embryo sac development thorough examination of permanent, stained serial sections.
16. Field study of several types of flower with different pollination mechanisms (Wind pollination, **thrips** pollination, bee/butterfly pollination, bird pollination).
17. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems. Study of cleistogamous flowers and their adaptations.
18. Study of nuclear and cellular endosperm through dissections and staining.
19. Isolalion of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.
20. Study of seed dormancy and methods to break dormancy.

Suggested Readings. (for Laboratory Exercises)

1. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology : A Laboratory Mannual, Springer-Verlag, Berlin-Heidelberg (and references therein).
2. Chopra, V.L. 2001. Plant Breeding : Theory and Practice. Oxford IBH Pvt. Ltd., New Delhi.
3. Chopra, y.L. 2001. Plant Breeding: Field Crops. Oxford IBH Pvt. Ltd., New Delhi.

Paper VIII –Cell and Molecular Biology of Plants

Scheme of Examination

Duration : 3 hours **Max. Marks : 100**

Note : The question paper will contain three sections as under –

Section A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10

Section B : 10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50

Section C : 4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks : 40

Unit-I

The dynamic cell : Structural organization of the plant cell, specialized plant cell types, chemical foundation, biochemical energetics.

Cell wall : Structure and functions, biogenesis, growth.

Plasma membrane : Structure, models and functions, sites for ATPases, ion carriers, channels and pumps, receptors.

Plasmodesmata : Structure, role in movement of molecules.

Unit-II

Chloroplast : Structure, genome organization, gene expression, RNA editing, nucleochloroplastic interactions.

Mitochondria : Structure, genome organisation, biogenesis.

Plant vacuole : Tonoplant membrance, ATPase, transporters, as storage organelle.

Nucleus : Structure, nuclear pores, nucleosome organization, DNA structure, A, B and Z forms, replication, damage and repair, transcription, plant promoters and transcription factors, mRNA transport nucleolus,rRNA biosynthesis.

Unit-III

Restriction enzymes : Cleavage of DNA into specific fragments, construction of a restriction map from the fragments, restriction sites as genetic markers, RFLP and their use in plant breeding.

Ribosomes : Structure, site of protein synthesis, mechanism of translation, initiation, elongation and termination, structure and role of tRNA.

Unit-IV

Protein sorting : Targeting of proteins to organelles.

Cell shape and motility :The cytoskeleton, organization and role of microtubules and microfilaments, motor movements, implications in flagellar and other movements.

Cell cycle and apoptosis: Control mechanisms, role of cyclins and cyclin-dependent kinases, retinoblastoma and E2F proteins. Cytokinesis and cell plate formation, mechanisms of programmed cell.

Unit-V

Other Cellular organelles : Structure and functions of microbodies, Golgi apparatus, lysosomes, endoplasmic reticulum:

Techniques in cell biology : Immunotechniques, in situ hybridization to locate transcripts in cell types, FISH, GISH, confocal microscopy.

Suggested Readings :

1. Lewis, B. 2000 Genes VII. Oxford University Press, New York.
2. Alberts, B., Bray, D. Lewis, J., Raff, M., Roberts, K and Watson, J., 1999. Molecular Biology of the Cell. Garland Publishing, Inc., New York.
3. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing USA.
4. Rost, T, etal. 1998. Plant Biology. Wadsworth Publishing Co., California USA.
5. Krishnamurthy, K.V. 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.

6. Buchanan, B.B., Gruissem, W., and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists. Maryland, USA.
7. De, D.N. : 2000. Plant Cell Vacuoles : An Introduction. CSIRO Publication Collingwood, Australia.
8. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York USA.
9. Lodish, H., Berk, A. Zipursky, S.L. Matsudaira, P., Baltimore D. and Darnell, J. 2000. Molecular Cell Biology (4th Edition) W.H. Freeman and Co., New York, USA.

See the following Review Journals

Annual Review of Plant Physiology and Molecular Biology.
Current Advances in Plant Sciences.
Trends in Plant Sciences.
Nature Reviews : Molecular and Cell Biology.

Suggested laboratory Exercises

1. Isolation of mitochondria and the activity of its marker enzyme succinate dehydrogenase (SDH).
2. Isolation of chloroplasts and SDS-PAGE profile, of proteins demarcate the two subunits of Rubisco.
3. Isolation of nuclei and identification of histones by SDS-PAGE.
4. Isolation of plant DNA and its quantitation by spectrophotometric method.
5. Isolation of DNA. And preparation of 'cot' curve.
6. Restriction digestion of plant DNA, its separation by agarose gel electrophoresis and visualization by ethidium bromide staining.
7. Isolation of RNA and quantitation by a spectrophotometric method.
8. Separation of plant RNA by agarose gel electrophoresis and visualization by EtBr staining.
9. Southern blot analysis using a gene specific probe.
10. Northern bolt analysis using a gene specific probe.
11. Immunological techniques : Ouchterlony method, ELISA and western blotting.
12. Fluorescence staining with FDA for cell viability and cell well staining with calcolflour.
13. Demonstration of SEM and TEM.

Note : Chemicals and kits for conducting some of the above molecular biology experiments are available in India, for example from M/s Bangalore Genei and Centre for Biotechnology (CSTR) Mall 'Road, Delhi.'

Suggested Reading (For laboratory exercises)

1. Glick, B.R. and Thompson, J.E. 1993, Methods in Plant Molecular, Biology and Biotechnology, CRC Press, Boca Raton, Florida.
2. Glover, D.M. and Hames, B.D. (Eds.), 1995. DNA Cloning 1: A Practical Approach, Core techniques. 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.
3. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology : Structure and Function Jones and Bartlett Publishers, Boston, Massachusetts.
4. Hackett, P.B., Fuchs, J.A.and Messing, J.W. 1988. An Introduction to Recombinant DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin Cummings Publishing Co.Inc. Menlo Park, California.
5. Hall, J.E. and Moore, A.L. 1983. Isolation of Membranes md Organelles from Plant Cells. Academic Press, London, U.K.
6. Harris, N and Oparka, K.J. 1994, Plant Cell Biology : A Practical Approach, IRL Press, at Oxford University Press, Oxford, U.K.
7. Shaw C.H. (Ed.), 1988. Plant Molecular Biology : A Practical Approach IRL press, Oxford.

Paper IX – Plant Resource Utilization and Conservation

Scheme of Examination **Duration : 3 hours** **Max. Marks : 100**

Note : The question paper will contain three sections as under –

Section A :	One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10
Section B :	10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50
Section C :	4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks : 40

UNIT – I

Plant Diversity : Concept, status in India, utilization and concerns.
Sustainable Development : Basic Concepts, origin of agriculture.
World Centers of primary diversity of domesticated plants : The Indo-Burmese center, plant introduction and secondary centers.

UNIT – II

Origin, evolution, botany, cultivation and uses of (i) Food, forage and fodder crops (ii) fiber crops (iii) medicinal and aromatic plants (iv) vegetable oil yielding crops.
Important firewood and timber yielding plants and non wood forest products (NWFPs) such as bamboos, rattans, raw materials for paper making, gums, tannins, dyes, resins and fruits.

UNIT – III

Green revolution : Benefits and adverse consequences, innovations for meeting world food demands.
Plants used as avenue trees for shade, pollution control and aesthetics : Principles of conservation, environmental status of plants based on IUCN.

UNIT – IV

Strategies for conservation – in situ conservation : International efforts and Indian initiatives, protected areas in India – sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs conservation of wild biodiversity.

UNIT – V

Strategies for conservation – ex situ conservation : Principles and practices, botanical gardens, field gene banks, seed banks, in vitro repositories, cryobanks, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBGPR), Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT) for conservation, non formal conservation efforts.

1. Anonymous 1997. National Gene Bank : Indian Heritage on Plant Genetic Resources (Booklet). National Bureau of Plant Genetic Resources, New Delhi.
2. Arora, R.K. and Nayar, E.R. 1984. Wild Relatives of Crop Plants in India. NBPGR Science Monograph No.-7.
3. Baker, H.G. 1978. Plants and Civilization (3rd edn.) C.A. Wadsworth, Belmont.
4. Bole, P.V. and Vaghani, Y. 1986. Field Guide to Common Indian Trees. Oxford University Press, Mumbai.
5. Chandel, K.P.S., Shukla, G. and Sharma, N. 1996. Biodiversity in Medicinal and Aromatic Plans in India : Conservation and Utilization. National Bureau of Plant Genetic Resources, New Delhi.
6. Chrispeels, M.J. and Sadava, D. 1977. Plants, Food and People, W.H. Freeman and Co., San Francisco.
7. Cristi, B.R. (ed.) 1999. CRC Handbook of Plant Sciences and Agriculture. Vol. I. In-situ conservation. CRC Press, Boca Raton, Florida, USA.
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Suggested Laboratory Exercises The Practical course is divided into three units : (I) Laboratory work, (2) Field survey and (3) Scientific visits.

Laboratory Work

1. Food crops : Wheat, rice, maize, chickpea (Bengal gram), potato, tapioca, sweet potato, sugarcane. Morphology, anatomy, microchemical tests for stored food materials.
2. Forage/fodder crops : Study of any five important crops of the locality (for example fodder sorghum, bajra, berseem, clove, guar bean, gram, Ficus sp.)
3. Plant fibers :
   (a) Textile fibres : cotton, jute, linen, sunn hemp, *Cannabis*.
   (b) Cordage fibres : coir
   (c) Fibres for stuffing : silk cotton or kapok
   Morphology, anatomy, (microscopic) study of whole fibres using -appropriate staining procedures.
4. Medicinal and aromatic plants : Depending on the geographical location college/university select five medicinal and aromatic plants each from a garden crop field (or from the wild only if they are abundantly available).

   Papaver somniferum, Atropa belladonna, Catharanthus roseus, Adhatoda cylanica (syn A. vasica) Allium sativum, Rauwolffia serpentina, Withania somnifera, Phyllanthus amarus, (P. fratermus), Andrographis paniculata, Aloe barbadens, Mentha arvensis, Rosa sp., Pogostemon cablin, Origanum vulgare, Vetiveria zizanioides. Jasminum grandiflorum, Cymbopogon sp., Pandanus odoratissimus.

   Study of live or herbarium specimens or other visual materials. to become familiar with these resources.

5. Vegetaible oils : Mustard, groundnut, soybean, coconut, sunflower, castor, Morphology, microscopic structure of the oil-yielding tissues, tests for oil and iodine number.

6. Gums, resins, tannins, dyes : Perform simple tests for gums and resins. Prepare a water extract of vegetable tannins *(Acacia, Terminalia, mangroves, tea, Cassia spp., myrobalans)* and dyes (turmeric, *Bixa orellana*, indigo, *Butea monosperma, Lawsonia inermis*) and perform tests to understand their chemical nature.

Field Survey

7. **Firewood and timber yielding plants and NWF's :**
   a. Prepare a short list of 10 most important sources of firewood and timber in your locality. Give their local names, scientific names, and families to which they belong. Mention, their properties.
   b. Prepare an inventory of the bamboos and rattans of your area giving their scientific and local names and their various uses with aprropriate illustrations.
   c. A survey of a part of the town or city should be carried out by the entire class, In batches. Individual students will select one avenue/road and locate the trees planted on a graph paper. They will identify the trees, mention their size, canopy shape, blossoming and fruiting period and their status (healthy, diseased, infested, mutilated, misused or dying) and report whether or not the conditions in which they are surviving are satisfactory. The individual reports will be combined to prepare a larger map of the area, which can be used for subsequent monitoring either by the next batch of students/teachers/local communities/NGOs/ or civic authorities. The purpose of exercise in item C above is to make the students aware of the kinds of trees and value in urban ecosystems and ecological services.

Scientific Visits*

The students should be taken to one of the following :

i. A protected area (biosphere reserve, national park, or a sanctuary)
ii. A wetland
iii. A mangrove
iv. National Bureau of Plant Genetic Resources, New Delhi-110012 or one of its field stations.
v. Head Quarters of the Botanical Survey of India or one of its Regional Circles.
vi. A CSIR Laboratory doing research on plants and their utilization.
vii. An ICAR Research Institute or a field station dealing with one major crop or crops.
viii. A recognised botnical graden or a museum (such as those at the Forest Research Institute, dehradun, National Botanical Institute, Lucknow, Tropical Botanical Garden and Reaserch Institute, Trivendram), which has collection of planrt products.

Note : The students are expected to prepare a brief illustrated narrative of the field survey and scientific Visits. After evaluation, the grades awarded to the students by the teachers should be added to the field assessment of the practical examination.

Paper X – Biotechnology, Genetic Engineering, Plant Breeding and Biometry

Scheme of Examination **Duration: 3 hours** **Max. Marks: 100**

Note: The question paper will contain three sections as under –

Section A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10

Section B : 10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50

Section C : 4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks : 40

UNIT – I

Biotechnology : Concepts and scope of biotechnology, plant tissue culture, anther and pollen culture, callus culture and protoplast culture.

Isolation, purification, culture and fusion, cybrids and hybrids, biotransformation, production of useful compounds through cell culture, vectors, plasmids and cosmids, cloning strategies. Basic concept of cDNA and genomic library. Recombinant DNA technology and its application. Genetic Engineering –Gene transfer, its importance and applications.

UNIT – II

Genetic Engineering of plants : Aims and strategies for development of transgenics, Transgenic plants –methods of production and their applications.

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. Germplasm conservation and Cryopreservation. Applications of rDNA technology.

Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

UNIT – III

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 profiling and its significance.

Bioactive compounds: Alkaloids, antioxidants, flavanoids, proteins and terpenoids.

UNIT – IV

Plant Breeding : Introduction, breeding methods in self and cross pollinated and vegetatively propagated crops, polyploidy and mutations and their uses in breeding, characterization of polyploids and mutants, Heterosis and inbreeding depression and causes of hybrid vigour, production and application of hybrid vigour in plant breeding.

UNIT – V

Biometry : Mean, mode and median, standard deviation and standard error, experimental errors, hypothesis testing, reliability and validity of results and inferences from experiments, variance, coefficient of variance, probability distribution, positive and negative bionomial, chi square test hypothesis, simple correlations.

Suggested Readings

1. Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture : Theory and Practice (a revised edition). Elsevier Science Publishers, New York. USA.
2. Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations : Elsevier Science Publishers, New York, USA.
3. Brown, T.A. 1999. Genomes. John Wiley & Sons (Asia) Pvt. Ltd. Singapore.
4. Callow, J.A., Ford-Lioyd, B.V. and Newbury, H.J. 1997. Biotechnology and Plant Genetic Resources : Conservation and Use. CAB International, Oxon, UK.
5. Chrispeels, M.J. and Sadava, D.E. 1994. Plants. Genes and Agriculture. Jones & Bartlett Publishers, Boston, USA.
6. Collins, H.A. and Edwards, S. 1998. Plant Cell Culture. Bios Scientific Publishers, Oxford, UK.
7. Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology. W.H. Freeman & Company, New York, USA.
8. Gustafson, J.P. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
9. Henry, R.J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall; London, UK.
10. Jain, 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 Academic Publishers, Dordrecht. The Netherlands.
11. Jolles, O. and Jornvall, H. (eds.) 2000. Protemics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
12. Kartha, K.K. 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida, USA.
13. Old, R.W. and Primrose, S.B. 1989. Principles of Gene Manipulation : Blackwell Scientific Publications, Oxford, UK.
14. Primrose, S.B. 1995. Principles of Genome Analysis : Blackwell Science Ltd., Oxford, UK.
15. Raghavan, V. 1986. Embryogenesis in Angiosperms : A Developmental and Experimental Study. Cambridge University Press, New York, USA.
16. Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, NewYork, USA.
17. Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety and Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
18. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers. The Netherlands.

Suggested Laboratory Exercises

1. Growth characteristics 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 di-deoxy 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 protoplasts and checking of transient expression of the reporter gene.
12. Co-cultivation of the plant material (e.g. leaf discs) with Agrobacterium and study GUS activity histochemically.

Suggested Reading (for Laboratory Exercises)

1. Butenko, R.G. 2000. Plant Cell Culture, University Press of Pacific.
2. Collin, H.A. and Edwards, S. 1998. Plant Cell Culture. Bios Scientific Publishers, Oxford, UK.
3. Dixon, R.A. (Ed.) 1987. Plant Cell Culture :Practical Approach. IRL Press, Oxford.
4. Gelvin, S.B. and Schilperoort, R.A. (eds.) 1994. Planl Molecular Biology Manual. 2nd edition, Kluwer Academic Publishers, Dordrecht. The Netherlands.
5. George, E.F. 1993. Plant Propagation by Tissue Culture. Part 1. The Technology, 2nd edition. Exegetics Ltd., Edington, UK.
6. George, E.F. 1993. Plant Propagation by Tissue Culture. Part 2. In Practice 2nd edition. Exegetics Ltd., Edington, UK.
7. Glick B.R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnolgy. CRC Press, Boca Raton, Florida.

8. Glover, D.M. and Hames, B.D. (Eds.) 1995. DNA Cloning 1 : A Practical Approach, Core Techniques, 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.
9. Hackett, P.B., Fuchs, J.A. and Meesing, J.W. 1988. An Introduction to Recombinant DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co., Inc. Menlo Park, California.
10. Hall, R.D. (Ed.) 1999. Plant Cell Culture Protocols. Humana Press, Inc., New Jersey, USA.
11. Shaw, C.H. (Ed.) 1988. Plant Molecular Biology: A Practical Approach, IRL Press, Oxford.
12. Smith, R.H. 2000. Plant Tissue Culture: Techniques and Experiments. academic press, New York.

Paper XI (a)
Advanced Plant Pathology -I

3 Hrs. Duration 100 Marks

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted.Total marks : 40

Unit I

Principles : History of plant pathology; The nature, origin and evolution of parasitism.

Interaction of pathogen, soil, other soil microorganism and the host, Biotrophic parasites in culture, Role of plant tissue culture in studies on host – parasite relationships.

Phenomenon of plant infection, penetration, infection, post infection development, factors affecting infection, defense mechanisms.

Unit II

Host pathogen interaction: The response of the host, pathogenecity and virulence, host specific toxins in relation to pathogenesis and disease resistance.

Nucleic acids in host parasitics and disease forecasting.

Plant disease control: Physical control, chemical control, plant quarantines, plant disease resistance and breeding of resistance varieties.

Methods : Techniques of isolation, purification, culture and inoculation of pathogens.Technique of tissue culture and its applications in plant pathology.Raising virus free plants in culture.

Unit III

Testing of efficacy of fungicides.

Fungal diseases: Symptomatology and disease identification,

Some important diseases of cereals: Smuts, rusts, leaf blights, spots, mildews, karnal burnt and flag smut of wheat; covered smut and stripe disease of barley. Brown spot and blast of paddy, Brown spot, downy mildews and Drechlera (Helminthosporium) blights of Maize; ergot and smut of Bajra, leafspots and smuts of jowar, green ear disease of Bajra.

Unit IV

Other Diseases : Red rot and smut of sugarcane; Fusarium wilt of cotton, flax and pigeon pea; flax rust; Asochyta blight of gram; early blight of tomato and potato; late blight of potato; Tikka disease of groundnut and downy and powdery mildews of grapes.

Unit V

Histopathology, calibration of microscopes and measurements. Knowledge of electron microscope in histopathological investigations. Writing for publication, literature collection and consultation, notes on experiments, photographs and illustrations (camera lucida drawings), writing and galley proofing of manuscripts.

Note: Practicals based on theory syllabus.

Paper XII (a)
Advanced Plant Pathology – II

3 Hrs. Duration 100 Marks

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted.Total marks : 40

Unit I

Classification and nomenclature of bacterial pathogens. Symptomatology
Methods of identification of bacterial pathogens:morphology, physiology, serology and pathogenecity;
Physiological and cytological aspects of bacterial infection process and disease development, mechanism of infection of bacterial pathogens.

Unit II

Bacterial disease: Brown rot, ring rot of potato, fire blight of stone fruits, tundu disease of wheat, stalk rot of Maize;
Bacterial blight of rice, soft rot of vegetables; red strip of sugarcane; crown gall disease ;
Angular leaf spot of cotton, citrus canker.

Unit III

Virology: Classification, morphology, physiology and nature of viruses; Symptomatology, isolation, purification and culturing of viruses;
Viral infection, nutrition , synthesis and mutation;
Transmission of viral diseases, Mycoplasma;
Acquired immunity, interference and synergism;
Viral diseases: Potato virus X and Y; Potato yellow dwarf; Tomato mosaic and tomato ring mosaic; Tobacco necrosis; Cucumber mosaic; Bunchy top of banana; Bhindi yellow mosaic.

Unit IV

Nematology: Classification and identification of plant pathogenic nematodes; Morphology and anatomy of nematodes;
Methods used in nematology;
Nematode disease: Ear cockle of wheat; Root knot of vegetables; Molya disease of wheat.
Non parasitic diseases : Diseases due to deficiency of Nitrogen, Zinc, Boron, oxygen, Preliminary studies on diseases due to excess of Ozone; PAN (Peroxyacyl nitrate), Sulfur di oxide, sulphur and Hydrogen fluoride in atmosphere, soil and water.

Unit V

Cecidology: Classification and anatomy of galls. Some insect induced plant galls of Rajasthan (Pongamia leaf galls, Cordia leaf galls, Zyziphus stem galls, Prosopis stem galls). Mechanism and physiology of insect galls.

Note : Practicals based on theory syllabus.

Paper XI (b) – Environmental Biology

Scheme of Examination

Duration : 3 hours **Max. Marks : 100**

Note : The question paper will contain three sections as under –

Section A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10

Section B : 10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50

Section C : 4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks : 40

UNIT – I

Ecosystem : Concept, structure and function of Grassland, forest, fresh water and Marine ecosystems, biogeochemical cycles, evolution of ecosystem, ecological energetic and flow of energy.

UNIT – II

Natural Resources: water, soil, energy and wild life management and their remediation, biodiversity conservation, sanctuaries, national parks, non-conventional energy sources, solar, wind, tidal and geothermal energy sources, 3 R's (Reduction, Recycle & Reuse).

UNIT – III

Air, water and soil pollution, types of pollutants – their sources and impact on humans, plants and animals. Noise, Land, radiation and thermal pollution – Sources and characteristics. Global Warming, ozone depletion and acid rains. Ganga Action Plan, Ecoleveling and Environmental Auditing, water pollution (Prevention and control of Pollution Act 1974). Air Pollution Act.

UNIT – IV

Consequences of growing human population on environment. Ecosystems : Man made ecosystems – Urban and rural. Environmental Impact Assessment (EIA), Social Impact Assessment (SIA) and sustainable development. Solid Waste Management.

UNIT – V

Environmental education and awareness : Environmental laws & Ethics: Wild Life Protection Act 1972. Poaching and killing of wild life. Forest conservation Act 1980, ecofeminism, Social forestry and role of tribals in conservation, environmental economics – issues in perspective global economy, ecopolitics and green policies.

Note: Practicals based on theory syllabus.

Paper XII (b) – Arid Zone Ecology

Scheme of Examination Duration : 3 hours

Max. Marks : 100

Note : The question paper will contain three sections as under –

Section A :	One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total Marks : 10
Section B :	10 question, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total Marks : 50
Section C :	4 questions (question may have sub division) covering all units descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks :40

UNIT – I

Deserts : their formation, topography and distribution, characteristics of deserts with special reference to water economy. The hot and cold deserts and other similar habitats, Arid regions of India with particular reference to Thar desert in Rajasthan.

UNIT – II

Rajasthan - Geology, physiography, climate, vegetations & plant communities of deserts and soil. Saline tracts and their vegetation (Halophytes), Mangrove vegetation, Sand Dunes – classification, stabilization and management

UNIT – III

Adaptation of plants and animals to arid conditions, Biotic factors including the role of man on the vegetation and fauna in arid zones, Types and distribution of wastelands in India

UNIT – IV

Habit studies and phenology of desert plants through various seasons, root investigation, reproductive capacity, seed output, germination, dormancy and viability, perennation.

UNIT – V

Desert as an ecosystem, biological productivity, cycles and balances in the desert ecosystems, wind break and shelter belts, Indira Gandhi Canal and its ecological implications, dry land farming, underground water resources.

Note: Practicals based on theory syllabus.

Skeleton Paper

M.Sc. (F) Papers VII, VIII, IX & X
Practical Examination

M.M. – 200 **Time -8 Hrs**

Q.No.			Mark Allotted
1.	(a)	Make suitable preparation of the given material. Draw labeled diagram, and study the anatomical features with special reference to its vascular structure. Discuss points of special interest.	14
	(b)	With the help of suitable preparation study the floral / seedcoat / epidermal / micro-sporangium wall structure of the material provided. Draw labeled diagram and comment upon its features.	14
2.	(a)	Identify any two ….. materials from the given samples. Give economic importance with special reference to origin, cultivation, part used and processing , if any.	14
	(b)	Mark the highest yield producing areas in the map (Rajasthan / India) provided to you	**12**
		OR	
	(b)	Mark the area of centre of origin of cultivated plants according to Vavilov.	
3.		(a)Perform the given molecular biology exercise.	14
		(b)Perform the given cell biology exercise.	14
4.		(a) Perform biotechnological exercise given to you.	14
		(b)Write details about the exercise given to you.	10
5.		Sports 1 to 8	24
6.		Records	30
7.		Viva-Voce	20
8.		Sessional	20

M.Sc. (F)
Practical Examination
Second Day (4 Hrs)
Advance Plant Pathology (Paper- XI-A & XII-A)

Q.No.	Questions	Mark Allotted
1.	Study the histapathology of the material 'A'. Make suitable preparation of the given material. Assign symptoms, causal organism and identify the disease making pathological note of the given material.	10
2.	Calibrate your microscope. Find out the average size of the fungal spore given to you.	
	OR	
	Draw the camera-lucida drawing of the given material.	10
3.	Study the given material 'B" write symptoms and etiology of the disease	05
4.	Make a comparative phyto-pathological note on the material 'C' and 'B'	10
5.	Study the histopathology of the material "E" Write points of special interest.	10
6.	Prepare a Bacterial preparation of the given material "F" using Gram Staining. Write and conclude about the results.	10
7.	Comment up on the spots 1 to 5	10
8.	Viva-Voce	10
9.	Records	15
10.	Sessional	10

Skeleton Paper
M.Sc. (F) Practical Examination
Special Paper – Advance Ecology XI (b) and XII (b)

Time : 4 hrs **M.M.: 100**

Q.No.		**Marks Alloted**
1.	Determine organic matter content of the given soil sample by Walkely & Black method. **Or** Determine the dissolved O_2 in a given water body by Winkler iodometric method.	15
2.	Prepare the glycerin mount of the given plant materials explaining their anatomical adaptations in relation to habitat. **Or** Study the various types of trichomes and their rolling mechanism to withstand during drought of given plant material.	20
3.	Determine the total hardness of the given water sample. **Or** Find out the leaf area index of polluted and non-polluted plants.	15
4.	Determine pH of the given soil sample by pH meter. **Or** Determine the conductivity of the given soil sample.	05
5.	Comment upon the spots (1-5)	10
6.	Practical Record	15
7.	Viva-Voce	10
8.	Sessional	10