Algae, Fungi and Lichens

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

General characters of algae. Classification (F.E.Fritsch and Smith), Diverse habitat, Range of thallus structure, Photosynthetic pigments and food reserves.

Reproduction (vegetative, asexual and sexual), Types of life cycles and evolution of sex in algae. Economic importance (algae as food and fodder, algae in agriculture, pharmaceuticals and industries). Isolation and culture of algae.

UNIT – II

Habitat, structure, reproduction and life cycle of following forms:

Chlorophyceae – *Volvox, Coleochaete, Chara*

Xanthophyceae – *Vaucheria*

Phaeophyceae – *Ectocarpus*

Rhodophyceae – *Polysiphonia*

UNIT – III

General characters of fungi: Definition, occurrence, thallus organization, asexual and sexual reproduction, biological and economic importance of fungi.

Classification of fungi. (Saccardo and Ainsworth's).

UNIT – IV

Brief account, structure, importance and life history of the following:

Yeast, *Rhizopus*, *Aspergillus*, *Peziza*, *Agaricus*.

Lichens: General characters, habitat, structure, reproduction and economic importance of lichens, importance of lichens as colonizers and indicators of environment.

Microbiology and Plant Pathology

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Meaning and scope of microbiology: Developments in the field of microbiology, spontaneous generation, discovery of bacteria, germ theory of diseases, Vaccination, Antibiotics.

General account of Eubacteria: occurrence, morphology (structure, shapes), flagella, capsule, nutritional types, endospore, reproduction (binary fission, transformation, conjugation, transduction), economic and biological importance.

UNIT – II

Mycoplasma: occurrence, morphology, reproduction and importance.

Virus: General characteristics and importance. Structure of TMV and Pox virus. Structure and multiplication of bacteriophage.

Cyanobacteria: *Oscillatoria* and *Nostoc*, occurrence, morphology, reproduction and importance.

UNIT – III

What is plant disease? Animate and inanimate plant diseases. Important symptoms of plant diseases caused by fungi, bacteria, viruses, MLO's

(blights, mildew – downy and powdery, rust, smut, mosaic, little leaf, galls etc.)

Brief account, structure, importance and life history and/or disease cycle and control of the following:

Albugo and white rust.

Sclerospora and downy mildew/ green ear of Bajra.

Claviceps and ergot.

UNIT – IV

Brief account, structure, importance and life history and/or disease cycle and control of the following:

Puccinia and rusts of wheat (Black, orange, yellow)

Ustilago and loose smut of wheat and covered smut of barley.

Alternaria and early blight of tomato/potato.

Bryophytes and Pteridophytes

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

General characters, Origin and evolution of Bryophyta. Classification (Eichler and Proskauer); Habitat, Range of thallus structure, Reproduction (Vegetative and Sexual); Alternation of generation; Evolution of sporophytes in Bryophytes; Economic importance of Bryophytes.

UNIT II

Habitat, structure, reproduction and alternation of generation in following forms: Hepaticopsida – *Riccia, Marchantia and Porella.*

Anthocerotopsida - *Anthoceros.*

Bryopsida - *Sphagnum, Funaria*

UNIT III

General characters of pteridophytes, classification by Smith, Bold & Sporne. Important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Habit & Habitat and economic importance of Pteridophytes. Alternation of Generation. Stelar system in Pteridophytes. Heterospory and seed habit.

Unit - IV

Distribution, structure and life history of: *Psilotum, Selaginella, Equisetum, Pteridium* and *Marsilea.*

Gymnosperms and Palaeobotany

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Resemblances and characteristics of seed plants. Differences between Gymnosperms and Angiosperms. General characters and classification of Gymnosperms (Andrews, Sporne & Bierhorst), Economic importance of Gymnosperms.

UNIT-II

Systematic position, distribution, Morphology of Vegetative and reproductive parts, anatomy, reproduction and life cycle of following genera: *Cycas, Pinus* and *Ephedra*

UNIT III

Formation of fossils, types of fossils, techniques of study of fossils. Geological time scale. Applied aspects of paleobotany - use in coal and petroleum exploration.

UNIT IV

Fossil Pteridophytes: *Rhynia, Lepidodendron, Calamites, Lepidocarpon.*

Fossil Gymnosperms - *Cycadeodea, Cordaites, .Williamsonia*

PLANT MORPHOLOGY AND ANATOMY

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

The basic body plan of flowering plants – modular type of growth. Diversity of plant forms in annuals, biennials and perennials; convergence of evolution of tree habit in gymnosperms, monocotyledons and dicotyledons; trees – largest and longest lived plants. Simple and complex permanent tissues, secretory tissues, tissue systems.

UNIT – II

The shoot system: The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes; branching pattern; monopodial and sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings; sapwood and heartwood; secondary phloem – structure and function; periderm. Anomalous secondary growth.

UNIT – III

The leaf: origin, development, arrangement and diversity in size and shape. Stomata – structure and types, stomatal index. Vascularization of leaf – nodal structure and venation; internal structure in relation to photosynthesis and water loss. Senescence and abscission.

The root system: root apical meristem; differentiation of primary and secondary tissues and their functions; structural modification for storage, respiration, reproduction and for microbial interaction with microbes.

UNIT – IV

Morphology and anatomy of seed (monocotyledons and dicotyledons). Significance of seed – suspended animation; ecological adaptation; unit of genetic recombination and replenishment; dispersal strategies.

Vegetative reproduction: Vegetative propagation, grafting; economic aspects.

CELL BIOLOGY AND PLANT BIOCHEMISTRY

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Cell Biology - Tools and techniques used in cell study; ultrastructure and functions of different cell organelles of eukaryotes and prokaryotes (cell wall, plasma membrane, nucleus, mitochondria, chloroplast, ribosomes, peroxisomes, golgi bodies etc.).

Cell divisions: cell cycle, mitosis phases, structure and functions of spindle apparatus; anaphasic chromosomes movement; Meiosis: phases, synaptonemal complex formation and fate of chiasmata and significance of crossing over.

UNIT – II

Chromosome organization: eukaryotic and prokaryotic, Chromosomes – morphology; centromere, telomere; specialized types of chromosomes (sex chromosomes, lampbrush chromosomes, polytene chromosomes). Chromosomal aberrations (Deletion, Duplication, Translocation and Inversion); Aneuploidy and polyploidy.

UNIT – III

Biomolecules:-

Carbohydrates: Importance, nomenclature, classification, structure and function of mono-, di- and polysaccharides, their properties, glycosidic linkages and glycoproteins.

Lipids: Importance of fatty acids (Saturated and unsaturated), biosynthesis (alpha and beta oxidation and synthesis).

Secondary metabolites: Concept of Secondary metabolites, classification and significance of Secondary metabolites with special reference to flavonoides, alkaloids and steroids.

UNIT – IV

Proteins: Importance of amino acids, structure, electrochemical properties, peptide bonds, chemical bonds and nomenclature, structure and classification of proteins, protein synthesis, physical and chemical properties, protein changes during seed germination, seedling and senescence.

Enzymes: Discovery, nomenclature, EC number, characteristics of enzymes, enzyme kinetics, mechanism of action, Km value, active sites, holoenzyme, apoenzyme, coenzyme and factors, multienzyme system, regulation of enzyme activity.

GENETICS AND PLANT BREEDING

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Experimental basis for DNA as genetic material; nucleic acids: DNA and RNA-their structures, types, replication and functions; RNA Primers, Okazaki-fragments, ideas about polymerase; exons and introns; DNA-Protein interactions, Nucleosome models; Structure of Gene; Regulation of gene expression in prokaryotes and eukaryotes; genetic code :triplet codes their characteristics and significance.

UNIT II

Genetic inheritance: Mendel's laws of inheritance and their exceptions; allelic (complete dominance, co-dominance and incomplete dominance, lethality) and non-allelic interactions (complementary genes, epistasis and duplicate genes), linkage and crossing over. Elementary ideas of chromosome mapping.

UNIT III

Cytoplasmic inheritance- maternal influence, shell coiling in snails, Kappa particles in *Paramaecium*. Multiple allelism: characteristics; ABO blood groups in men. Multiple gene inheritance: characteristics; plant height;

grain colour in wheat, Extra nuclear genome; presence and function of mitochondrial and plastid DNA; plasmids; transposons.

UNIT IV

Plant Breeding

Introduction and objectives of plant breeding; general methods of plant breeding (Introduction and acclimatization, selections, hybridizations); hybrid vigour and inbreeding depression. Role of mutation and polyploidy in plant breeding. Famous Indian and international plant breeders and their work. National and international agricultural research institutes.

Plant breeding work done on wheat and rice in India; Green revolution. Methods of breeding in self-pollinated and cross-pollinated and vegetatively propagated crop plants.

PLANT PHYSIOLOGY AND METABOLISM

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Water relations:

Water: structure, physicochemical properties, importance to plant life, concept of water potential. Absorption of water and Transport of water: Ascent of sap, Mechanism of process: Transpiration, Guttation, stomatal movement, limiting factors.

Mineral Nutrition: Essential micro and macro nutrients; their uptake, factors affecting, hydroponics and nutrient requirement, deficiency and toxicity symptoms.

Transport of organic substances: Mechanism of phloem transport, factors regulating the translocations of nutrients.

UNIT II

Photosynthesis: Photosynthetic apparatus, photochemistry, pigments, light reaction, photo system I & II, Z scheme, photophosphorylation, C_3 Calvin cycle, C_4 cycle, photorespiration, Crassulacean acid metabolism and factors affecting the photosynthesis.

UNIT III

Respiration: ATP-the biological energy currency, aerobic and anaerobic respiration, Kreb's cycle, electron transport system, oxidative phosphorylation, Pentose phosphate pathway, respiratory inhibitors and factors affecting the process.

Nitrogen Metabolism: Biological N_2 fixation by free living organism, symbiotic N_2 fixation, root nodules, nitrogenase and ammonium assimilation.

UNIT IV

Phases of growth and development: Seed dormancy and germination, plant movement, senescence and Biological clock- their regulatory factors. Photoperiodism & vernalisation; Physiology and mechanism of action, concept of florigen and phytochrome.

Plant hormones : auxins, gibberellins, cytokinins, ethylene and growth retardants; discovery, bioassay & physiology.

PLANT TAXONOMY

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Introduction, Principles of Taxonomy, Units of Classification, Concept of Genus and Species. Binomial Nomenclature, International Code of Botanical Nomenclature. Taxonomic Literature; Botanical Gardens and Herbaria.

UNIT - II

Development of Taxonomy and History of Different System of Classification. Bentham and Hooker's System of Classification. Engler and Prantle System of Classification. Evolutionary Trends in Angiosperms. Primitive and Advanced Characters.

UNIT - III

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae.

UNIT - IV

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Apocynaceae,

Asclepiadaceae, Convolvulaceae, Solanaceae Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae.

EMBRYOLOGY AND ECONOMIC BOTANY

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Ontogeny of the flower parts- development and variations. Structure of anther, microsporogenesis, Tapetum- types and function ,development of male gametophyte, structure of pollen grains.

Types of ovule, Megasporogenesis, development of female gametophyte(Embryosac) . Pollination,Pollination types. Fertilization, double fertilization, significance of double fertilization.

UNIT - II

Development of Dicot and monocot embryo, Formation of embryo, Types of embryo. Endosperm, Types of endosperm, Endosperm haustoria. . Polyembryony, Induced polyembryony. Parthenocarpy, Apomixis and adventive embryony.

UNIT - III

Basic concept of center of origin of cultivated plants. Food plants- rice, wheat, maize, potato, sugarcane. Vegetables: General account with a note on radish, onion, garlic, cabbage, spinach, cauliflower, cucumber, tomato, lady finger and pea. Fruits: General account with a note on apple, banana,

ber, mango, mulberry, jamun, watermelon, muskmelon, guava and orange. Vegetable oil: groundnut, mustard and coconut.

UNIT - IV

Spices: General account with an emphasis on those cultivated in Rajasthan: (Cumin, Capsicum, Coriander). Beverages: Tea and coffee. Medicinal plants: General account with an emphasis on plant species cultivated in Rajasthan (Senna, Isabgol, Safed musli).Fibers: Cotton and jute. Wood: General account of sources of firewood ,timber and bamboos; Rubber. Ethnobotany: a general account.

MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

Unit – 1

History of molecular biology: work of Chargaff, Watson and Crick model of DNA, Meselson and Stahl replication experiment ; Hershey and Chase experiment, Chromatin structure and gene expression, S. Benzer and gene concept. Kary Mullis and Polymerase chain reaction, Application of PCR technique, an overview of DNA fingerprinting and its use.

Unit-2

Central dogma , Reverse transcriptase and its application, Transcription in eukaryotes, RNA processing, capping, splicing and polyadenylation, Translation, initiation, elongation and termination. Jacob-Monod and Lac operon, Negative and positive control, attenuation and antitermination, structure of promoter.

Unit-3

Biotechnology : Functional definition. Basic aspects of Plant tissue culture, basal medium, media preparation and aseptic culture technique. Concept of cellular totipotency. Differentiation and morphogenesis.

Micropropagation and synthetic seeds. Protoplast culture and somatic hybridization. Anther culture for androgenic haploid. Ovule and embryo culture and their application.

Unit-4

Recombinant DNA technology: techniques used in rDNA technology. Restriction enzymes. Vectors for gene transfer, Plasmids and cosmids, cDNA library, gene amplification ; Transgenic plants.

PLANT ECOLOGY

Scheme of examination: *MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Plants and Environment: Atmosphere (gaseous composition and properties of four distinct zone viz. stratosphere, troposphere, mesosphere and thermosphere): water (distribution in biosphere and properties of water cycle): Morphological, anatomical and physiological responses of plants to water (Hydrophytes and Xerophytes). Light: global radiation, photosynthetically active radiation.

UNIT II

Zonation in water body: littoral, limnentic and profoundal zones; photoperiodism, heliophytes and sciophytes, Temperature (Raunkier's classification of plants: megatherm, mesotherm, microtherm, heikistotherm; themoperiodicity and vernalisation). Soil (soil profile, development - weathering and maturation. Soil texture, soil types, role of pH, organic matter, soil water, soil nutrients. Interactions among organisms (neutralism, amensalism, allelopathy, competition, predation, parasitism, protocooperation, mutuallism).

UNIT III

Population, Community, Ecosystem and Phytogeography: Population ecotypes, ecades. Community characteristics: stratification, life forms and biological spectrum, frequency density and cover. Ecological succession: types (primary and secondary), mechanism: nudation, migration, ecesis, reaction and climax; xerosere, hydrosere.

UNIT IV

Ecosystems: Structure-abiotic and biotic components, trophic level, food chain, food web, ecological pyramids, energy flow (Box and Pipe model of Odum). Biogeochemical cycles of carbon and phosphorus; Vegetation types of India.

CELL BIOLOGY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

Introduction to modern tools and techniques of cell biology: advances in light and electron microscopy, techniques supplementing microscopy (cytochemistry, microprobe analysis, x-ray diffraction, etc.), Cell fractionation and visualization/characterization of various cell fractions.

The Dynamics of cell, shape and motility: Structural organization of the plant cell, biochemical energetics. cytoskeleton, microtubules and microfilaments, motor and flagellar movements.

Cell wall, plasma membrane and plasmadesmata: Structure and functions, biogenesis, growth models and functions, sites for ATPases, ion carriers, channels and pumps, receptors. Role in movement of molecules and macromolecules, comparison with gap junctions.

Chloroplast and mitochondria: Structure,, Organization and function of mitochondrial and chloroplast genomes, diversity and evolution of organelle genomes, chloroplast protein targeting to different compartments, mitochondrial DNA and male sterility, transfer of genes between nucleus and organelles.

Plant vacuole: Structure and function

Other Cellular organelles: Structure and functions of micro-bodies, Golgi apparatus, ribosomes, lysosomes, endoplasmic reticulum.

Nucleus: Structure, nuclear pores, nucleosome organization, nucleolous,

Chromatin organization : Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, nucleolus and ribosomal RNA genes, euchromatin and heterochromatin, karyotype analysis, banding patterns, karyotype evolution, specialized types of chromosomes, polytene, lampbrush, B-chromosomes and sex chromosomes, molecular basis of chromosome pairing.

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 death.

ALGAE, FUNGI AND BRYOPHYTA

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

Algae: Algae in diversified habitats (terrestrial, fresh water and marine), thallus organization; cell ultra structure; reproduction (Vegetative asexual and sexual); classifications of algae based on pigments, cell wall composition, reserved food material and flagellation; salient features of cyanophyta, chlorophyta, bacillariophyta, xanthophyta, pyrrhophyta ,phaeophyta and rhodophyta with special reference to *Spirullina, Nitella, Pinnularia , Gonyaulax , Laminaria, Gelidium* and *Batrachospermum* ; Economic importance of algae specially in industries, food , fodder, biofertilizers and algal blooms. Isolation and culture of algae.

Fungi: General characters; substrate relationship; cell ultra structure; thallus

organization; cell wall composition ; nutrition (saprobic, biotropic and symbiotic); reproduction (vegetative, asexual and sexual), heterothallism; heterokaryosis; parasexuality; sex hormones and recent trends in classification of fungi;Phylogeny of fungi; general account of mastigomycotina, zygomycotina, ascomycotina, basidiomycotina and

deuteromycotina with special reference to *Physarum, Perenospora, Neurospora, Polyporus , Drechslera and Colletotrichum*. Fungi in industries, medicines and as food. Fungal diseases in plants and animals including humans; Mychorrhizae; fungi as biocontrol agents.

Bryophytes: Morphology, structure, distribution, reproduction and classification of bryophytes; General account of marchantiales, jungermaniales, anthocerotales, sphagnales, funariales and polytrichales with special reference to *Plasiochasma, Notothylus* and *Polytrichum* . Economic and ecological importance of bryophytes.

M.Sc Semester I Botany Paper III P C 11-1063

GENETICS AND PLANT BREEDING

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

Gene Structure and expression : Genetic fine structure, cis-trans test, fine structure analysis of eukayotes, 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 of 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, 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.

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.

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 microdissection and microcloning, flow cytometry and confocal microscopy in karyotype analysis.

Plant Breeding

Genetic system and breeding methods: Reproduction and breeding systems in plants. Recombination, genetic control and manipulation of breeding systems including male sterility and apomixis. Selection and breeding strategies for self-pollinated, cross-pollinated and clonally propagated crop plants, breeding for crop quality, biotic and abiotic stresses, gene pyramiding for multi-trait incorporation.

M.Sc Semester I Botany Paper IV P C 11-1064

PTERIDOPHYTES, GYMNOSPERMS & PALEOBOTANY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

Pteridophytes; Morphology, anatomy, reproduction; classification, distribution life history and general account of fossil pteridophytes , psilopsida , lycopsida, sphenopsida and pteropsida classes with special reference to *Tmesipteris*.

Morphology, anatomy, reproduction; classification, distribution life history of: *Lycopodium ,Gleichenia ,Dryopteris ,Isoetes* and *Ophioglossum.*

Origin and evolution of stele, heterospory and seed habit.

Economic importanceof pteridophytes

Gymnosperms; Morphology, anatomy, reproduction; classification, distribution, life history and evolution.

Brief account of families of **Pteridospermales** (Lygenopteridaceae, Medullosaceae, Caytoniaceae ,Glossopteridaceae;), **Cycadeoidales** , **Cordaitales** and **living gymnosperms** (families of Cycadals, Ginkgoales, Coniferales , Ephedrales, Welwitschiales and Gnetales)

Formation and types of fossils, techniques of study of fossils, geological time scale, Applied aspects of paleobotany; use in coal and petroleum exploration.

M.Sc Semester II Botany Paper V P C 11-2061

MOLECULAR BIOLOGY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

Cell signaling: Hormones and their receptors, Cell surface receptors, signaling through G protein coupled receptors, signal transduction pathways, mechanism and cellular response to environmental signaling.

Cellular communication: Regulation of hematopoiesis, General principles of cell communication, Cell adhesion and role of different adhesion molecules, Gap junctions,
Extracellular matrix integrins, Neurotransmission and its regulation.

DNA Replication: Prokaryotic and eukaryotic DNA replication- Unit of replicon, enzymes involved, mechanism of DNA replication origin and replication fork, fidelity of replication, accessory proteins involved in DNA replication, extra chromosomal replicon. Structure and function of different types of RNAs- mRNA, t-RNA, r-RNA, snRNA, small nuclear proteins, ribosomes- subunits and its molecular structure and functions, Genetic codenuclear and organelle.

Transcription: Prokaryotic and eukaryotic transcription: Transcriptional factors and machinery, RNA polymerases, regulatory elements and mechanism of transcription regulation- formation of initiation complex,

transcription activators and repressors, capping, elongation, and termination, RNA processing, RNA editing, splicing, polyadenylation, RNAtransport- nuclear transport of m RNA, mRNA stability.

Translation: Prokaryotic and eukaryotic translation- translational machinery, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, aminoacylation of tRNA, aminoacyl tRNA synthetase, termination of translation, regulation of translation, translational proof-reading, translational inhibitors, co and post-translational modifications of proteins.

Control of gene expression at transcription and translational level: Regulation of phages, viruses, prokaryotes and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

M.Sc Semester II Botany Paper VI P C 11-2062

TAXONOMY OF ANGIOSPERMS

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

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 relationships, 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.

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, 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 socio-economic importance.

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

M.Sc Semester II Botany Paper VII P C 11-2063

MICROBIOLOGY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

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1. General characteristics of microorganisms, scope, history and development of microbiology, contribution of Van Leeuwenhock- Joseph Lister, Pasteur, Koch, Jenner.

2. **Classification of microorganisms;** Haeckel's three kingdom concept, Whittaker's five kingdom concept. Modern trends in classification (ribotyping, nucleic acid hybridization, RNA fingerprinting, molecular chronometer).

Salient features of Bergey's manual of systemic Bacteriology

Occurrence, salient features and designation of following-

Gram Negative bacteria: Spirochaetes, Aerobic or microaerophilic, Anaerobic bacteria, Rickettsias and Anoxygenic phototrophs, Oxygenic phototrophs, Mycobacteria, Actinomycetes. Archaebacteria: Methanotrophs, Halophiles, and Sulfur dependent archaebacteria. Pathogenic types of toxins (exotoxin, endotoxin and enterotoxin), nonspecific and specific defense mechanisms.

1. **Morphology & Ultra structure of Bacteria**.

2. **Cultivation of Bacteria;** anaerobic, aerobic culture media, growth curve, growth kinetics, batch, continuous culture, growth measurements. Pure culture techniques, preservation methods.

3. **General account of Mycoplasma-** Characteristics, cell morphology, diseases caused in plants by mycoplasma.

Physiology and Metabolic Diversity among Microorganisms- Nutritional classification of microorganisms- chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms. Photosynthesis in microorganisms; Nitrate and oxidizing bacteria; Nitrate and sulfate reduction; Syntrophy; Nitrogen metabolism; Nitrogen fixation; Hydrocarbon transformation. Motility and bioluminescence.

Viruses- Nomenclature, classification, properties and structure of viruses. Life cycle and pathogenesis of following RNA virus- Picorna, ortho, Rabdo, Hepatitis and HIV

Vaccinations. DNA viruses- pox, herpes, Measles. Vaccination and vaccines

Interferon.

Immunology: General account of immunity, allergy, properties of antigens and antibodies. Antibody structure and function, affinity and antibody specificity,

Monoclonal antibodies and their uses, antibody engineering, serology.

Application of Microbiology: application of microbiology in industrial, agriculture and waste management: symbiotic nitrogen fixation, Mycorrhiza and VAM fungi, Siderophores and other PGRs.

Food Microbiology: Contamination and spoilage of food products, Food preservation methods. Application of microbial enzymes in food industry, Microbiology of fermented milk products.

Industrial Microbiology: Industrial production of alcohol, citric, acid, solvents, amino acids, enzyme, antibiotics. Microorganism in mineral recovery; microbial degradation of petroleum and hydrocarbons. Pesticides and other recalcitrant chemicals (Xenobiotics). Preliminary account of Biofilms, biochips, biosensors and biosurfactants.

M.Sc Semester II Botany Paper VIII P C 11-2064

PRINCIPLES OF PLANT PATHOLOGY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

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.

Information technology in plant pathology: Preliminary account of application of information technology in plant pathology.

Symptomatology, identification and control of following plant diseases:

Fungal diseases*:* Wheat - Rust, Smut, Bunt

Pearl millet - Green ear, ergot and smut

Crucifers – rust

Paddy- Paddy blast

Cotton - Wilt

Grapes -Downy mildew and powdery mildew

Bacterial diseases: Wheat (Tundu), Citrus canker.

Viral diseases: Tobacco mosaic, Bhindi yellow mosaic.

Phytoplasma disease: Little leaf of brinjal

Nematode diseases: Root-knot of vegetables.

M.Sc Semester III Botany Paper IX P C 11-3061

PLANT PHYSIOLOGY & METABOLISM

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Water relation of plants: Unique physiochemical properties of water Chemical potential, Water potential, Apparent free space, Bulk movement of water. Soil plant atmosphere continuum(SPAC), Stomatal regulation of transpiration.

Membrane transport: Passive nonmediated transport. Nernst equation. Passive mediated transport. ATP driven active transport. Uniport, Symport, Antiport, Ion channels.

Preliminary account of stress physiology, secondary metabolites and Circadian rhythms in Plants

Photobiology: Photoreceptors, Phytochrome-History, discovery, physiological properties. Interaction between hormones and phytochrome, role of different phytochromes in plant development and flowering.

Photosynthesis: Photosynthetic pigments, absorption and transformation of radiant energy, photo-oxidation, : photosystem I & II, non cyclic and cyclic transportation of electrons (photophosphorylation), Calvin cycle and its control, Regulation of RUBP carboxylase activity. C4 pathway,

CAM pathway. Differences b\w c3 and c4 plants. Glycolate pathway and photorespiration, chlororespiration .

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, α- and β–oxidation.

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

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

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

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

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

Physiology of flowering: Photoperiodism and Vernalization.

M.Sc Semester III Botany Paper X P C 11-3062

PLANT MORPHOLOGY & DEVELOPMENTAL ANATOMY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

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 during seed germination and seedling growth, hormonal control of seedling growth, gene expression, use of mutants in understanding seedling 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, Primary and Secondary tissue differentiation, 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 epidemis (with special reference to stomata and trichomes) and mesophyll, Leaf traces and leaf gaps, Petiolar anatomy.

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

Seed coat development: Ontogeny of seed coat, mature structure, Spermoderm pattern.

PLANT ECOLOGY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 marks each and with internal choice. The limit of answer will be five pages per question.

Introduction to ecology, evolutionary ecology, ecological models; Characteristics of population, population size and exponential growth, limits of population growth, population dynamics, life history pattern, fertility rate and age structure, population growth. Competition and coexistence, intra-specific interactions, interspecific interactions, scramble and contest competition model, mutualism and commensalism, prey-predator interactions.

Vegetation organization: Concepts of community and continuum, community coefficients, interspecific associations, ordination, Species Diversity and Pattern Diversity in Community, Concept of Habitat and 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, Concept of Climax Nature of ecosystem, production, food webs, energy flow through ecosystem.

Biogeochemical Cycles (global) of C, N, P and S, resilience of ecosystem, ecosystem management. The biosphere, biomes and impact of climate on biomes.Biodiversity – assessment, conservation and management, biodiversity act of India and related international conventions. Sustainable development, natural resource management in changing environment. Molecular ecology, genetic analysis of single and multiple population, molecular approach to behavioural ecology, conservation genetics.

M.Sc Sem III Botany Paper XII(a) P C 11-3064

ADVANCED PLANT PATHOLOGY-I

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Plant Pathology : History & Scope. Nature, Origin. & Evolution of parasitism. Biotic and abiotic pathogens, Pathogen factors in disease development. Penetration, infection and pathogenesis. Physiological specialisation in phytopathogenic microbes.

Host factors in disease development. Inoculum Potential, Phenomena of resistance and susceptibility. Protective and defence mechanisms in plants, Phytoalexins. Breeding for disease resistance plants. **Environmental factors in disease development**. Epiphytotics and plant disease forecasting. Principles of plant protection. Physical, chemical and biological control of plant diseases, IPM, Application of biotechnology and information technology in pest management.

Molecular Plant Pathology : Molecular diagnosis, identification of genes and specific molecules in disease development molecular manipulation of resistance. Non-parasitic diseases and control measures.

Classification and anatomy of galls: Some insect induced plant galls of Rajasthan, mechanism and physiology of insect galls.

M.Sc Sem III Botany Paper XII(b) P C 11-3065

ENVIRONMENTAL BIOLOGY & ARID ZONE ECOLOGY-I

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

ECOSYSTEM: Structure and ecological processes in the Grassland, Forest, Freshwater and Marine ecosystems, Urban and Rural ecosystems. Air, water, soil & noise pollution**:** Kinds, sources, quality parameters, effects on plants and ecosystems; Remediation of soil, water (municipal) and air pollution, Green belt. Solid wastes and their management, 3Rs (Reduction, Recycle & Reuse) Principle; Social Forestry.

Climate Issues: Greenhouse gases (CO_2, CH_4, N_2O, CFCs: sources, trends and role) and consequence of greenhouse effects (CO_2 fertilization, global warming, sea level rise, Biodiversity erosion), ozone layer depletion and its consequences, Applications of GIS and Remote Sensing technology in environmental studies, the future of planet earth.

Policies, Regulations & related issues: Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and Control of Pollution) Act 1981; Environment (Protection) Act 1986, Wild Life protection)Act 1972; Forest (Conservation) Act 1980; Environment auditing, Environment Impact Assessment, Bioindicator and biomarkers of environmental health**;** Environment economics, Ecopolitics and green policies; Ecolevel.

M.Sc Sem IV Botany Paper XIII P C 11-4061

PLANT REPRODUCTIVE BIOLOGY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Reproduction : Vegetative options 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, 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 systems, commercial considerations, structure of the pistil, pollen-stigma interactions, sporophytic and gametophytic self-incompatibility (cytological, bio'chemical 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 development, 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.

PLANT RESOURCE UTILIZATION & ETHANOBOTANY

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Plant Biodiversity : Concept, status in India, utilization and concerns Sustainable development : Basic Concepts. Origins of agriculture.

World centres of primary diversity of domesticated plants : The Indo-Barmese centre, plant introductions and secondary centres.

Origin, evolution, botany, cultivation and uses of (i) Food, forage and fodder crops, (ii) fibre crops, (iii) medicinal and aromatic plants and (iv) vegetable oil-yielding crops.

Important fire-wood 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.

Green revolution : Benefits and adverse consequences. Innovations for meeting world food demands. Plants used as avenue trees for shade, pollution control and aesthetics.

Plants used as avenue trees for shade ,pollution control and aesthetics. Principles of conservation, extinctions, environmental status of plants based on International Union for Conservation of Nature.

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.

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 (NBPGR), 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.

PLANT BIOTECHNOLOGY & GENETIC ENGINEERING

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Plant Tissue culture: Principles, Concept, History, General methodology, culture media ingredients, preparation, methods of sterilization and disinfestations, aseptic techniques and preparation of explants, histological and photographic techniques for plant tissue culture.

Micropropagation in plants, Shoot morphogenesis and organogenesis, callus and suspension cultures, microspore culture and its importance.

Somatic embryogenesis: Principles, concepts and applications.

Protoplast technology: Isolation methods, purification, viability tests, culture, plating efficiency, Somatic cell hybridization, selection of protoplast fusion hybrids, Applications. Somaclonal Variation.

Plant tissue culture and Secondary metabolite production. Overview of Plant Tissue Culture Applications.

Recombinant DNA Technology: tools and techniques, construction of genomic/cDNA libraries, polymerase chain reaction, DNA fingerprinting

Vectors for plant transformation: Basic features of vectors (Promoters and terminators, selectable markers, reporter genes, origin of replication, Co-integrative and binary vectors), Optimization, clean gene technology.

Techniques for plant transformation: *Agrobacterium* mediated gene transfer, process of T-DNA transfer and integration, practical applications of *Agrobacterium*-mediated gene transfer, Direct gene transfer methods. The genetic manipulation of Herbicide tolerance, pest tolerance, plant disease resistance. Reducing the effects of viral disease, Strategies for engineering stress tolerance, Improvement of crop yield and quality, Molecular farming of carbohydrate &lipids(Starch, polyfructans, bioplastics), proteins(custom made antibodies, edible vaccines, oleosin system).

Metabolic Engineering and industrial Products: control mechanisms and manipulation of phenylpropanoid pathway, alkaloids, industrial enzymes, biodegradable plastics, polyhydroxybutyrate, therapeutic proteins, Antibiotics, ethanol, Polyketides, Vitamins, Biopolymers , Biological Pigments , Amino acids, solvents.

Science and society: Public acceptance of genetically modified crops(Public concerns, current status of transgenic crops, concerns about GM crops, regulation of GM crops and products),Introduction to Intellectual property, Biosafety guidelines ,Environmental release of GMO's,Risk analysis, Risk Assessment, Risk management.

M.Sc Sem IV Botany Paper XVI(a) P C 11-4064

ADVANCED PLANT PATHOLOGY-II

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Fungal diseases : Symptomatology, disease identification and control of flag smut wheat, covered smut of barley, blast of paddy, smut Jowar, Red rot of sugarcane, flax rust, early blight of potato.

Bacteria : Classification and nomenclature of bacterial plant pathogens. Methods of identification of bacterial pathogens (morphology, physiology, serology and pathogenicity).

Bacterial diseases : Brown rot of potato, blight of rice, soft rot of vegetables, Crown gall disease, angular leaf spot of cotton.

Virus, viroid and phytoplasma disease : Symptomatology and transmission of viral diseases; Potato virus X & Y, Tomato ring mosaic, bunchy top of banana; viroids and important viroid diseases. Phytoplasma General account; Sesame phyllody, Spike disease of sandal.

Nematology : Brief history, classification and identification of plant pathogenic nematodes.

Morphology and anatomy of nematodes. Methods used in Nematology. Control of plant parasitic nematodes. Nematode Disease : Molya disease of wheat & barley/ear cockle of wheat, root-knot disease.

M.Sc Sem IV Botany Paper XVI(b) P C 11-4065

ENVIRONMENTAL BIOLOGY & ARID ZONE ECOLOGY-II

Scheme of examination: *MM: 70*

(1) The Semester End Examination (SEE) for theory will be of 70 marks and of 3 hours duration, having 5 questions, in all.

(2) Question No. 1 shall consist of 7 Short Answer Questions of 2 marks each, based on knowledge, understanding and applications of the topics/texts covered in the syllabus.

(3) Question No. 2 to 5 will be of 14 mark each and with internal choice. The limit of answer will be five pages per question.

Desert, their formation, topography, distribution and characteristics of world deserts, Hot and cold deserts with reference to India; Desert as an ecosystem, biological production with particu1ar reference to conservation of flora and fauna.

Sand dunes classification, stabilization and management of sand dunes; wind breaks and shelter belts, afforestation and desert control measures. Vegetation of Rajasthan desert and plant communities; The saline tracts and their vegetation (Halophytes) with special reference, to Rajasthan; Economic and social considerations in the management of salt affected soils, afforestation in salt affected soils

Water problems in Rajasthan particularly underground water resources and its change, Rain water harvesting, Dry land farming, Arid lands and Horticultural crops, Indira Gandhi Canal and its ecological implication, Waterlogging & salinity problems- The management alternatives.