

आज दिनांक 19.10.2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :-

Date :- 19.10.2011

Subject :- Botany

Committee Place :- Central Library

1. Dr. V. K. Tiwari
2. Dr. V. K. Bhatnagar
3. Dr. M. Rafiq Ahmad Jabri

Proposed Syllabus for B.Sc. Botany

B.Sc. I year

There will be Three theory papers and a practical examination as follows:

Paper I	- Diversity of Viruses, Bacteria & Fungi	M. M.: 50
Paper II	- Diversity of Algae, Lichens, & Bryophytes	M. M.: 50
Paper III	- Diversity of Pteridophytes & Gymnosperms	M. M.: 50

(There will be 9 questions in each paper and candidate has to attempt only 5 questions. Q.1 will be compulsory based on units I - IV. Two questions will be set from each unit of which one question has to be attempted. All questions will carry equal marks.

Practicals: Based on papers I- III M. M.: 50

The course details are as follows:-

Paper I: Diversity of Viruses, Bacteria, & Fungi M.M. 50

Unit-I

History, nature and classification of Viruses, Bacteria and Fungi.

History of virology and bacteriology; prokaryotic and eukaryotic cell structure (bacteria, mycoplasma and yeast); structure, classification and nature of viruses; structure (gram positive and gram negative) and classification (based on cell structure) of bacteria; classification, thallus organisation and reproduction in fungi; economic importance of fungi.

Unit-II

Viruses:Symptoms of virus infection in plants; transmission of plant viruses; genome organisation, replication of plant virus (tobacco mosaic virus); techniques in plant viruses - purification, serology and electron microscopy; structure and multiplication of bacteriophages; structure and multiplication of viroids.

Unit-III

Bacteria:Nutritional types of bacteria (based on carbon and energy sources), metabolism in different nutritional types (basics only) and nitrogen cycle; bacterial genome and plasmids; bacterial cell division, variability in bacteria - mutation, principles of genetic recombination; techniques in sterilisation, bacterial culture and staining; economic importance.

Unit-IV

Fungi:The characteristics and life cycles of the following:

Mastigomycotina: *Albugo, Pythium*,; **Ascomycotina:** *Saccharomyces, Aspergillus, Ascobolus*;
Basidiomycotina : *Ustilago, Puccinia, Polyporus, Agaricus*; **Deuteromycotina:** *Fusarium*.

Paper II - Diversity of Algae, Lichens, and Bryophytes

M.M. 50

Unit-I

General characters. Range of thallus organization, classification, ultrastructure of eukaryotic algal cell and cyanobacterial cell, economic importance of algae. Lichens, classification, thallus organization, reproduction, physiology and role in environmental pollution.

Unit-II

The characteristics and life cycles of the following:-

Cyanophyta *Microcystis, Oscillatoria*; **Chlorophyta** *Volvox, Hydrodictyon, Oedogonium, Coleochaete, Chara*; **Bacillariophyta** *Navicula*; **Xanthophyta** *Vaucheria*; **Phaeophyta**; *Ectocarpus*
Rhodophyta *Polysiphonia*

Unit – III

Bryophytes, general characters, classification, reproduction and affinities. Gametophytic and sporophytic organization of:

Bryopsida: *Pogonatum*; **Anthocerotopsida:** *Anthoceros*

Unit - IV

Gametophytic and sporophytic organization of **Hepaticopsida** : *Riccia, Marchantia*.

Paper III – Diversity of Pteridophytes, Gymnosperms and elementary Palaeobotany

M.M. 50

Unit - I

Pteridophytes: General features, classification, stellar system and its evolution. Comparative study of morphology, anatomy, development, vegetative and reproductive systems of following:

Lycopsidea - *Lycopodium, Selaginella*; **Psilopsida**- *Rhynia*

Unit – II

General and comparative account of gametophytic and sprophytic system in

Filicopsida -*Pteridium, Nephrolepis. Marsilea.*

Heterospory and seed habit.

Unit - III

Gymnosperms: General characters, classification. Comparative study of morphology, anatomy, development of vegetative and reproductive parts in:

Cycadales: *Cycas*

Unit –IV

Study of morphology, anatomy, development and reproductive parts in:

Coniferales – *Pinus* ; **Gnetales** - *Ephedra*

Affinities and relationship of Gymnosperms, evolutionary significance.

Elementary Palaeobotany: general account, types of fossils, methods of fossilization and geological time scale.

B.Sc. II year

Paper I: Diversity of Angiosperms: Systematics, Development & Reproduction M.M. 50

Paper II: Cytology, Genetics, Evolution & Ecology M.M. 50

Paper III: Plant Physiology and Biochemistry M.M. 50

(There will be 9 questions in each paper and candidate has to attempt only 5 questions. Q.1 will be compulsory based on units I - IV. Two questions will be set from each unit of which one question has to be attempted. All questions will carry equal marks)

Practicals: Based on papers I-III M.M. 50

Paper - I: Diversity of Angiosperms: Systematics, Development & Reproduction M.M. 50

Unit - 1

Systematics

Principles of classification, nomenclature; comparative study of different classification systems, viz. Linnaeus, Bentham & Hooker, Engler & Prantl, Hutchinson, and Cronquist. Herbarium techniques and important Botanic Gardens.

Unit – II

Taxonomic study of following families and their economic importance:

Dicots; Nymphaeaceae, Nelumbonaceae, Ranunculaceae, Malvaceae, Bombacaceae, Brassicaceae, Cucurbitaceae, Rosaceae, Leguminosaceae, Myrtaceae, Rutaceae, Apiaceae, Apocynaceae, Solanaceae, Convolvulaceae, Cuscutaceae, Scrophulariaceae, Acanthaceae, Lamiaceae, Asteraceae, Rubiaceae, Euphorbiaceae, and Amaranthaceae.

Monocots: Cyperaceae, Poaceae, Arecaceae, Liliaceae.

Unit - III

External morphology of vegetative and floral parts; modifications – phyllodes, cladodes, and phylloclades.

Meristems-kinds study of tissue system - epidermal, ground, and vascular.

Anatomy of roots, stems, and leaves. Cambium - its function and anomalies in roots and stems.

Unit – IV

Structure and development of male and female gametophytes – microsporogenesis microgametogenesis, megasporogenesis, and megagametogenesis, embryo sac types. Double fertilization development of embryo, endosperm development and its morphological nature, apomixis and polyembryony.

Paper II: Cytology, Genetics, Evolution & Ecology M.M. 50

Unit - I

Cell structure, cell organelles, nucleus, chromosome structure, nucleosome and solenoid model, salivary gland, lampbrush and B chromosomes.

Cell division – mitosis, meiosis; their significance, chromosomal aberrations

Unit- II

Genetics, laws of inheritance; gene interaction; linkage and; cytoplasmic inheritance; sex determination.

Unit-III

Mutation- spontaneous, induced mutations, molecular mechanism and evolutionary significance; polyploidy-origin, kinds and role in evolution. Evidences and theories of evolution.

Unit - IV

Ecology, relation with other disciplines. Plant types: Hydrophytes - *Hydrilla*, *Eichhorina*, *Nymphaea*, *Typha*. Xerophytes – *Nerium*, *Casuarina*, *Saccharum*, *Begonia*. Plant succession – xeroseres, hydroseres. Ecosystems - concept, basic types, components, & functioning.

Paper III - Plant Physiology and Biochemistry.

M.M. 50

Unit - I

Plant and water relationship, colligative properties of water, free energy concept. Water uptake, conduction, transpiration, mechanism and its regulation by environmental variables.

Mineral nutrition : Macro, and micronutrients, their role, deficiency and toxicity symptoms, plant culture practices, mechanism of ion uptake and translocation.

Unit - II

Photosynthesis and Chemosynthesis : photosynthetic pigments, O₂ evolution, photophosphorylation, CO₂ fixation - C₃- C₄ and CAM plants.

Respiration : aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs 'cycle, electron transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanide resistant respiration. Lipid biosynthesis and its oxidation.

Unit - III

Nitrogen metabolism : atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation,

Growth: general aspects of phytohormones, inhibitors-auxins. kinetin, gibberellins, and ethylene: action and their application; photoperiodism and vernalization. Germination, growth movements, parthenocarpy, abscission and senescence.

Unit - IV

Biomolecules : Classification, properties and biological role of carbohydrates, Protein and lipids. Chemistry of nucleic acids.

Discovery and nomenclature. Characteristics of enzymes, concepts of holoenzyme, apoenzyme, coenzyme and cofactors. Regulation of enzyme activity, Mechanism of action.

B.Sc. III year

Paper I:	Plant resource utilisation, Palynology and Biostatistics	M.M. 75
Paper II:	Molecular biology & biotechnology	M.M. 75
Paper III:	Environment Botany and Plant Pathology	M.M. 75

(There will be 9 questions in each paper and candidate has to attempt only 5 questions. Q.1 will be compulsory based on Units I - IV. Two questions will be set from each unit of which one question has to be attempted. All questions will carry equal marks)

Practicals: Based on papers I-III M.M. 75

Paper I Plant Resource utilization, Palynology and Biostatistics 75 marks

Unit I

Centres of diversity of plants, origin of crop plants. Domestication and introduction of crop plants. Concepts of sustainable development; cultivation, production and uses of - wheat, rice, legumes, sugarcane

Unit II

A general account of plants yielding oils, spices, beverages. An account of major fiber, medicinal, petro, plants of Uttar Pradesh.

Unit III

Conservation of plants resources for agriculture and forestry.

In situ conservation sanctuaries, national parks, biosphere reserves, wetlands, mangroves.

Exsitu conservation; botanical gardens, field gene banks, seed banks, cryobanks.

Unit IV

An introductory knowledge to palynology, morphology, viability and germination of pollens.

Classification of data, mean, median and mode. Standard deviation, standard error, variance, co-relation, X^2 test and experimental designs

Paper II: Molecular biology and biotechnology M.M. 75

Unit – I

Nucleic acid as genetic material, nucleotides, structure of nucleic acids, properties of genetic code, codons assignments, chain initiation of codons mechanism of protein synthesis and its regulation.

Unit - II

Structure and properties polysaccharides, aminoacids, proteins, vitamins and hormones; Enzymes: active sites, specificity, mechanisms, factors, general aspects of enzyme kinetics. Bioenergetics: Laws of thermodynamics, concept of Gibb's free energy, high energy compounds.

Unit - III

Replication of DNA in prokaryotes and eukaryotes, gene expression and regulation. Hormonal control and second messengers Ca⁺, Cyclic AMP, IP₃ etc.

Unit- IV

Introduction to biotechnology, recombinant DNA technology, plant tissue culture, methods of gene transfer, transgenic plants, biotechnology and healthcare, microbial and environmental biotechnology.

Paper III- Environmental botany and plant pathology

M.M. 75

Unit - I

Mineral resources of planet earth, Conservation of mineral resources. soils; types, properties and various problem soils; water; the source of water, physico-chemical and biological properties of water. Sustainable management of water; energy resources in India; Forests: global forest wealth, importance of forests, deforestation.

Unit - II

Environmental pollution : air, water, soil, radioactive, thermal and noise pollutions, their sources, effects and control. (greenhouse effect, ozone depletion and acid rain). CO₂ enrichment and climate change.

Unit - III

Biodiversity and Phytogeography : biotic communities and populations, their characteristics and population dynamics. Natural vegetation of India, static and dynamic plant geography, basic principles governing geographical distribution of plants, endemism.

Unit - IV

Etiology of viral, bacterial, fungal and insect-pest diseases: mosaic diseases on tobacco, and cucumber, yellow vein mosaic of bhindi; citrus canker, potato scab, little leaf of brinjal; damping off of seedlings late blight of potato, red rot of sugarcane

Integrated pest disease management

Recommendation:

1. **B.Sc. I** : Provided syllabus B.Sc. I was read & discussed thoroughly and it has been approved with minor changes. A copy of the syllabus provided with minor corrections is being submitted herewith.

2. **B.Sc. II**: Provided syllabus of B.Sc. II was also discussed critically & the following changes have been made;

Unit –I: approved as such

Unit-II: Eight families have been deleted, while one family e.i. Asclipi has been included Unit-III: approved as such

Unit-IV: In addition to the course mentioned Unit IVth of (Palynology) of Paper II (B.Sc.-III) have been added as palynology in more befitting at this place.

Paper II: The title of paper is new; Plant Physiology:- This paper has been critically analysed & now it has been fractionated in four units:

The provided syllabus has included biochemistry in paper III which has been shifted to B.Sc. III paper II, become chemistry is more relevant with molecular biology.

B.Sc. III:

The names of papers have been revised as per need & scope of the subject. Paper I: Plant resource utilization and Biostatics

Paper II: Molecular biology and biochemistry
Paper III: Environment botany and Biochemistry

Paper Ist: Units I, II, III have been retained as such while a part of unit (IV) e.g. Palynology- has been shifted to B.Sc. II paper Ist unit IV. E.g. Pollen morphology is closely related to that part.

Paper IInd : Unit I & II have been retained as such while unit 3rd & IV have been shifted to paper III. In place of these units IV of paper III class B.Sc. II (i.e. Biochemistry) has been included at the place of unit III & Unit IV.

Paper III: Unit I, II & III have been maintained as such while unit IV has been replaced with unit 3rd & 4th of paper II (B.Sc. III).

Note: Syllabus of B.Sc. I comprising of paper I, II & III is being submitted with minor necessary corrections. It may be considered in the nearly by academic council for immediate implementations from the current session. i.e. 2011-12.

Botany

For M.Sc. (Previous & Final)

There shall be 10 Compulsory papers (1 to 10) which will be covered in two years. Five compulsory papers are to be opted for M.Sc. (Previous) Exam, and remaining five papers to be opted for M.Sc. (Final) examination. There will be practical examination in both the previous & Final class.

M.Sc. (Previous)

Paper I - Phycology and Microbiology

II - Mycology and plant pethology

III - Bryophyta, pteridophytes and gymnosperms

IV - Plant Physiology and crop physiology

V - Cytology and molecular biology.

M.Sc. Final

VI - Taxonomy, Economic botany and Morphogenesis

VII - Morphology, Anatomy, embryology and tissue culture.

VIII - Ecology and soil science

IX - Biochemistry and Photobiology

X - Genetics, plant breeding and biostatistics.

Practical Examination—

M.Sc. Previous -	200 Marks
M.Sc. Final	200 marks
The broad distribution of marks is an undar :—	
1- The practicals based on 5 theory papers	140 Marks
2- Viva-Voce	20 Marks
3. Collection and report of plant collection trip	20 Marks
4. Sessional record	20 Marks
5. Plant collection tour (s) are compulsory for all candidates	

Botany (M.Sc. Previous)***Paper I*****Phycology & Micro-biology M.M. 100**

The candidates are required to attempt five questions but not more than three questions from any section.

Section (A) Phycology

1. Classification of algae
2. Phylogeny and inter-relationship among the principal groups of algae
3. Range of structure and organization in algae.
4. Sexuality in algae.

5. Algal pigments and hormones:
6. Economic importance of algae
7. General characters of the algal classes and comparative account of structure and reproduction of the following taxa:—
 - A— Myxophyceae : Chroococales, Nostocales
 - B— Chlorophyceae : Volvocales, chaetophorales conjugales
 - C— Xanthophyceae : Heterosiphonales.
 - D— Phaeophyceae : Ectocarpales, Laminariales & Fucales.
 - E— Rhodophyceae : Nemalionales Rhodymeniales & Ceramiales.
 - F— Bacillariophyceae : Diatoms General Account.

Section (B) Microbiology

1. Classification, structure, reproduction & Economic importance of bacteria.
2. Actinomycetes : Classification, structure & antibiotics.
3. Slime molds : Structure & reproduction.
4. Viruses : Nature, properties, structure, multiplication, transmission, and bacteriophages.
5. Rickettsia : A general account.
6. Mycoplasma : A general account.
7. Cancer biology : A general account.
8. Host microbes interaction and immunity.

Paper II**Mycolog & Plant Pathology**

The candidates are required to attempt five questions but not more than three questions from any section.

Section (A) Mycology

1. A general account and classification of fungi.
2. Comparative structure, reproduction and phylogeny of the following taxa—
 - A. Phycomycetes : Chytridiales, Blastocladales, Entomophthorales, saprolegniales, peronosporales & Mucorales.
 - B. Ascomycetes : Endomycetales, protomycetales, Erysiphales, sphaeriales, and pezizales.
 - C. Basidiomycetes : Uredinales, Ustilaginales, Exobasidiales, Agaricales and Lycoperdales.
 - D. Deuteromycetes : Malanconiales and Moniliales.
3. Phylogeny of fungi; fungi as a test organism.
4. Antibiotics and elementary industrial mycology.
5. Lichens : A general account.

Section (B) Plant Pathology

1. Nature causes and classification of plant diseases.
2. Inoculum and means of dissemination.
3. Phylogeny of infected host; changes in the physiological processes, toxins and their role.
4. Genetics of host pathogen relationship. physiological specialization.

5. Control measures and defence mechanism including culture practices, chemical and biological control and resistance.
6. Symptoms causal organism, disease cycle and control measures of the following.
 - a. Rot and Damping off; Damping off of tobacco seedlings, red rot of sugarcane.
 - b. Downy mildews : Downy mildew of Bajra and Grapes.
 - c. Powdery mildew : Powdery Mildew of cucurbits.
 - d. Rusts; Rusts of wheat & linseed.
 - e. Wilts : wilts of pigeon pea.
 - f. Leaf spot & blights; Early & late blights of potato. Blast disease of rice.

paper III

M.M. 100

Bryophytes, Pteridophytes & Gymnosperms

The candidates are required to attempt five questions but not more than 3 questions from any section.

Section (A) Bryophytes

1. Classification, General characteristics, Distribution and affinities of Bryophytes.
2. Comparative morphology, anatomy and reproduction of the following taxa : Calobryales, Takakiales, sphaerocarpaceae, Marchantiales, Jungermanniales, Anthocerotales, Sphagnum, Andreales and polytrichales.
3. Fossil history of bryophytes.
4. Origin and evolution of sporophytic and gametophytic generations.

Section (B) Pteridophytes

1. General Characteristics, classification, comparative morphology, anatomy reproduction, affinities and phylogeny of the following—
 - A. Psilophytosida Psilophytales.
 - B. Psilotosida; Psilotales.
 - C. Lycopsida; Lepidodendrales, Isoetales.
 - D. Sphenopsida; Sphenophyllales, Calamitales.
 - E. Pteropsida; Ophioglossales; Osmundales, Filicales (Gleicheniaceae, Metoniaceae, Cyatheaceae, Adiantaceae), Salviniaceae.

Section (C) Gymnosperms

1. Classification, General characteristics, distribution, affinities and phylogeny of gymnosperms.
2. Comparative morphology, anatomy, reproduction and affinities of the following gymnosperms —
 - A. Pteridospermales; Pteridospermaceae, Lyginopteridaceae, Medullosaceae.
 - B. Caytoniales : Caytoniaceae.
 - C. Cycadales: Cycadaceae.
 - D. Cordaitales; cordaitaceae.
 - E. Ginkgoales; Ginkgoaceae.
 - F. Pentaxylales; pentaxylaceae.
 - G. Coniferales; Pinaceae, Araucariaceae, taxodiaceae, cupressaceae, podocarpaceae, cephalotaxaceae, taxaceae.
 - H. Gnetales; Gnetaceae (Gnetum)

PAPER IV**Plant Physiology & Crop Physiology****M.M. 100**

The candidates are required to attempt five questions but not more than three questions from any section.

Section (A) General Plant Physiology

- 1- Introduction, Scope of plant physiology, Bio-energetics, structure and function of cell and cell wall.
- 2- Soil-plant-water relations; Absorption, translocation, evaporation, osmotic quantities.
- 3- Mineral element; Absorption, translocation and role of micro and macro-nutrients (elements), deficiency and toxicity symptoms, deficiency diseases.
- 4- Translocation and mobilization of solutes (cellular traffic)
- 5- Growth and development; Dynamics of growth processes, factors effecting growth, chemical regulation of growth, mode of action and physiological effects of growth substances: auxins, Gibberellins, cytokinins, abscisic acid, phenolic compounds, ethylene, morphactins.
- 6- Physiology of seed germination, dormancy, abscission and senescence, effects of various growth substances on these processes.
- 7- Reproductive physiology: physiology of flowering, photoperiodism, vernalization, role of growth substances in flowering.

Section (B) Crop Physiology

- 1- Water requirement of crops and water logging
- 2- Physiological principles of dryland crop production

- 3- Physiology of rooting in plants
- 4- Physiology of tuber and bulb formation
- 5- Physiology of fruit ripening
- 6- Post harvest physiology of fruits and tuber crops
- 7- Stress physiology: salt, water and frost resistance in crop plants in relation to recent hypotheses
- 8- Weeds and weed control.
- 9- Role of anti-Transpirants in arid agriculture.

PAPER V

Cytology & Molecular Biology

M.M. 100

The candidates are required to attempt five questions but not more than three questions from any section.

Section (A) Cytology

- 1- History of Cytology.
- 2- Cytological techniques, killing, fixation, staining, isolation of cell and cell organelles.
- 3- Ultra-Structure of cell and cell organelles, their origin & functions
- 4- Ultra structure, organization and function of nucleus in prokaryotes and eukaryotes.
- 5- Chromosomes. Morphology, Ultra- structure, different types of chromosomes, chemical organization, functions and significance.
- 6- Euchromatin and heterochromatin. Ultra-structure, distribution and significance.

- 7- cell cycle, cell division, details of crossing-over and chiasmata formation.
- 8- Structural Changes in the chromosomes their significance and cytological details.

Section (B) Molecular Biology

- 1- Chemistry and Biosynthesis of DNA : Replication of DNA, DNA Polymerase and ligase (Mechanism of action) : synthesis of biologically active viral DNA replication of tumor viruses, reverse transcription.
- 2- Chemistry and biosynthesis of RNA : RNA polymerase, polynucleotide, phospholylase, replication of RNA viruses
- 3- Operon modal of regulation of protein synthesis in prokaryotes; inducible systems; repressible systems, lactose, arabinose and histidine operations lamda phase regulation.
- 4- Transcriptional control; mechanistic details of transcriptions sigma and rho factors, processing of RNA.
- 5- Post transcriptional and translational control
- 6- Molecular biology of extra-chromosomal DNA and viruses, plasmids, chloroplast mitochondrial and other organells DNA : DNA & RNA viruses amplification and cloning.
- 7- Introduction of genetic materials into cells; sexual and parasexual means of genetic transfer in bacteria, difference between prokaryotes and eukaryotes at the information transfer level; homologous and heterologous gene transfer.

PRACTICAL

1. Determination of the minimum size of quadrat by species-area-curve Method.
2. Determination of the minimum number of quadrats by species—area-curve method.

3. Determination of quantitative characters such as Density, Relative Density, Abundance and Percentage frequency of different species by quadrat method.
4. Determination of Important-Value-Index (IVI) of different species.
5. Preparation of Frequency diagram as suggested by Raunkiaer.
6. Determination of cover and basal area of dominant species.
7. Preparation of biological spectrum of a locality on the basis of life-forms.
8. Study of root system of various category of plants.
9. Determination of above and underground biomass by harvest method.
10. Germination studies in petridishes.
11. Determination of seed output and reproductive capacity.
12. Study of physical and chemical characters of the soil by rapid field tests.
13. Determination of the water holding capacity of the soil.
14. Evaluation of soil pH.
15. Determination of chlorophyll by calorimetry.
16. Estimation of calorific values of plant materials by Bomb-calorimetry.
17. Growth analysis of plants : Evaluation of relative growth rate (RGR), Net Assimilation rate (NAR), Leaf Area Ratio (LAR) and Leaf Area Index (LAI).
18. To study the productivity of any cultivated crop in terms of biomass and energy.
19. To study allelopathic effect of certain weeds on some crops.
20. To study the effect of some climatic, edaphic and biotic factors on the growth of plants.
21. To determine pore volume percentage (porosity) of the given soil sample.
22. To find out different types of soil water in the given soil sample.

Botany

M. Sc. (Final)

PAPER VI:

Morphology, Taxonomy of Angiosperms and Economic Botany

The candidate will be required to attempt Five questions in all. Question No. 1 will be compulsory, it shall be of, objective type and should cover the entire syllabus of the paper. For the remaining four questions the candidate shall attempt one question from section 'A' two from Section 'B' and one from section 'C'

SECTION—VI 'A'

Morphology

1. Origin and evolution of Angiosperms.
2. Morphology of flower and its organs particularly—
Stamens and carpel, Placentation, Ontogeny of floral organs.

SECTION-'B'

Taxonomy of Angiosperms

1. Definition, scope and importance of taxonomy as the basis of Botanical science.
2. History of Plant Taxonomy (Due emphasis is to be given to Indian work).
3. Principles of Plant Taxonomy. International Code of Botanical Nomenclature,

4. Field and herbarium techniques. Floristics, Botanical Gardens. Important Herbaria and Botanical survey etc.
5. Modern trends in Plant Taxonomy including bearing on Cytology, Embryology, Anatomy Biochemistry, Palynology, etc.
6. Important systems of Classification. Detailed study of Systems Proposed by Bentham Hooker, Engler & Prantl, Bessey Hutchinson, Takhtajan and Cronquist.
7. Vegetative and floral characters, economic importance and affinities of the following families (Special reference to the flora of Rohilkhand and the adjacent areas)

Magnoliaceae	Annonaceae	Cannabinaceae
Moraceae	Cactaceae	Tiliaceae
Sterculiaceae	Euphorbiaceae	Combretaceae
Rhamnaceae	Vitaceae	Sapindaceae
Anacardiaceae	Verbenaceae	Chenopodiaceae
Nymphaeaceae	Polygonaceae	Onagraceae
Amaranthaceae	Lythraceae	Solanaceae
Rfimulaceae	Campanulaceae	Lentibulariaceae
Scrophulariaceae	orobanchaceae	Alismaceae
Oxalidaceae	Boraginaceae	Typhaceae
Butomaceae	Hydrocharitaceae	Orchidaceae
Potamogetonaceae	Commelinaceae	
Dioscoreaceae	Agavaceae	
Poaceae		

students are also expected to have a complete knowledge of the families which they have read at the B. Sc. level.

SECTION-'C'**Economic Botany**

1. Plants and their value in the service of the mankind.
 2. Fibres— Cotton Flax, Jute, Hemp and Coir, Elementary knowledge of textile and paper industries in India.
 3. Timbers Woods—their identification properties and uses. Details of Teak, Shisham, Saal, Chir, Deodar, Neem, Mango, Babul and Jamun.
 4. Tannins
 5. Dyes
 6. Gums and Resins
 7. Rubber and latex
- | | |
|--|--|
| <ol style="list-style-type: none"> 4. Tannins 5. Dyes 6. Gums and Resins 7. Rubber and latex | <p>General account, plant part from which these are obtained. Method of extraction and uses.</p> |
|--|--|
8. Oils—Essential oils, their properties, antibiotics methods of extraction and uses.
 9. Fatty oils General account and detailed study of ground nut, peanut, sesame. Musturd, coconut cotton seed, castor, linseed and sunflower oils.
 10. Sugars—Sugar cane and sugar beet.
 11. Medicinal plants: Details of Aconitum, Ephedra, Gugal, Atropa, Aloe; Tulsi, Neem, Bhang, opium, Catharanthus, Nuxvomica, Isabgul, Cinchona, Sarp-gandha, Artemisia and other important local plants.
 12. Spices:—Ginger, Turmeric, Asafoetida, Cinnamon, Clove. Black-peper and Chillies,
 13. Beverages: Non - alcoholic-coffee, Tea, Coca, Alcoholic- General account.
 14. Fumitories and masticatories: Tobacco, Betel and Betel nut.
 15. Concise knowledge of origin and evolution of crop plants and including their centres of origin.
 16. Ethnobotany: General account.

paper VII**Plant Anatomy, Plant Embryology & Morphogenesis**

The candidates will be required to attempt five questions, two questions from section 'A', two from section 'B' and one from section 'C'

SECTION 'A'**Plant Anatomy**

1. History of plant anatomy.
2. Techniques of Anatomy, Section cutting, Mounting and Microscopy.
3. Primary meristems. Basic structure of shoot and root apices.
4. Vascular cambium, its organization and seasonal activity, anomalous secondary growth, cork cambium, its structure, organization and its derivatives.
5. Phloem and Xylem.
6. Nodal anatomy.
7. Leaf:-general features, Epidermis structure, ontogeny, distribution and systematic value of stomata and trichomos.
8. Anatomy of flower, fruit and seed'
9. Modern trends in the study of Anatomy.

SECTION—B**PLANT EMERYOLOGY**

1. History of Embryology.
2. Micro sporogenesis and male-gametophyte.
3. Megasporogenesis and female gametophyte.

4. Fertilization.
5. Endosperm.
6. Embryo, seed and fruit its development.
7. Apomixis, Polyembryony and Parthocarypy.
8. Experimental embryology with particular reference to the work Carried out in India.
9. Modern trends in Embryology.

SECTION—C

PLANT MORPHOGENES

1. Aims and scope, including phenomenon of Morphogenesis, correlation Symmetry, Polarity, Regeneration Totipotency Sex expression and flowering.
2. Morphogenetic factors, physical, Chemical and genetical.
3. Techniques and application of plant tissue culture (with special reference to Indian contribution).
4. Centres of Morphogenetic work done in India.
5. Modern trends in Plant Morphogenesis.

Paper VIII

Ecology, Soil science and Phytogeography.

The candidates are required to attend 5 questions, 3 questions from section A and 2 questions from section B. Q. 1 will be compulsory and it shall be of the objective type and should cover the entire syllabus and the paper.

SECTION—A**ECOLOGY**

1. Introduction and scope of ecology.
2. Environmental factors, Climatic, edaphic, biotic and topographic.
3. Plant Succession, hydrarch xerařch, succession, climax concept.
4. Biological spectrum and life forms.
5. Limnology : The freshwater environment and limiting factors. Ecological classification of freshwater organism. Brief description of lentic (standing water) and lotic (running water) communities.
6. Autecology– objectives, importance, methods of study.
7. Vegetational analysis : Methods of studying vegetation analytical and synthetic characters of the community.
8. Ecosystem concept and its components, types of ecosystem, Energy flow trophic levels, food chain and food webs, pyramid of numbers, biomass and energy, biochemical cycles.
9. Production ecology : Measurement of primary production, quantitative, measurements of primary productivity in terrestrial and aquatic environments, Ecological efficiency.

10. Ecotypic concept:- Climatic, edaphic and biotic ecotypes; Ecads Gene-ecology.
11. Pollution-air, water and soil, with special reference to nuclear and noise pollution, control, measures, remote sensing and satellite imageries, bio-indicators of pollution.
12. Important centres of ecological researches in India.

SECTION—B

SOIL SCIENCE AND PHYTOGEOGRAPHY

1. Definition, classification and physical and chemical characteristics of soil.
2. Development of soil, soil profile, effects of climate and vegetation on the developments of soil profile.
3. Different types of soils in India.
4. Problems and prospects of saline soils and alkaline soils and their reclamation.
5. Soil erosion and conservation.
6. Phytogeography—Principles and problems of plant distribution, endemism, floristic regions and vegetation types of India.

PAPER IX**Biochemistry and photo Biology****Section (A)****BIOCHEMISTRY**

M. M. 100

Attempt any five questions, All questions carry equal marks.

1. Biochemical basis of life.
2. The cell—its biochemical organisation.
3. Physical and chemical phenomenon in Biochemistry.
 - A. Laws of thermo- dynamics.
 - B. Activation of energy.
 - C. pH scale
 - D. Chemical potential.
 - E. Redox potential.
 - F. Stiocheiometry and calculation of empirical formulae in biological systems.
4. Water—The basic molecule of life : Molecular structure, Physical and chemical properties in relation of life processes.
5. Carbohydrate metabolism.
6. Carbohydrate and lipids.
7. Nucleic acids, purines, pyrimidines, nucleotide & nucleosides, molecular structure of DNA & biosynthesis, structure RNA and biosynthesis, ariulor DNA viral DNA viral RNA.
8. Biological Nitrogen fixation, Importance, source of nitrogen, and mechanism cf Nitrogen fixation, Nitrogenase (structural subunits and properties, control of biosynthesis).

9. Structure and biosynthesis of amino acids and proteins, Source of Nitrite—Nitrate reduction, amides, amino acids and protein synthesis.
10. Carbon assimilation, photosynthesis & glyoxylate pathway, productivity.
11. Release of energy, importance of energy auxiliaries, Respiration, P-phosphate pathway & importance.
12. Enzymes, structure, properties, mode of action and regulation, kinetics, coenzymes.
13. Vitamins.
14. Alkaloids and steroids.
15. Biological membranes, Biochemical components, unit membrane hypothesis, molecular organization, Transport across membrane phosphorylation and Na-K pump, energisation of active transport.
16. Cyclic AMP, A metabolic rejuvenation of second, structure, biosynthesis and degradation, glycogen metabolism.
17. Biochemical control of gene expression, Induction of enzyme, repression, feedback inhibition B-Galactosidase, regulation control of enzyme synthesis operon.
18. Tools and techniques, Spectrophotometry paper chromatography column chromatography Thin layer chromatography Ion exchange chromatography, Gas liquid chromatography, gel filtration, polyacrylimide gel electrophoresis chromatofocussing atomic absorption spectrum photometry.

SECTION (B)

PHOTOBIOLOGY

1. **Bioluminescence.**
2. **Phytochromes.**
3. **Photoblasticity in seeds.**

paper-X**Genetics, plant breeding and biostatistics**

The candidates will be required to attempt five questions, two from section 'A' and two from section 'B' and one from section 'C'

SECTION (A)**GENETICS**

1. Mendelism and interaction of factors, chisquare test.
2. Linkage, chromosome mapping, interference, and coincidence.
3. Qualitative and quantitative characters, multiple gene hypothesis.
4. Fine gene analysis : Nature and concept of gene, types of genes, structure, function and expression.
5. Allelism, multiple alleles, pseudoalleles, isoalleles and pleiotropy.
6. Genetics of microbes, virus, bacteria and Neurospora, E. coli and cancer.
7. Sex determination and sex linked inheritance. (Special reference to plants).
8. Extra-nuclear inheritance.
9. Gene mutation, molecular basis of mutation, their induction, isolation and significance.
10. Genetic engineering, gene recombination technology, gene counselling, gene therapy and clinical genetics.

SECTION (B)**PLANT BREEDING**

1. Plant breeding : Introduction, objects and significance.

2. Methods of plant breeding in relation to self pollinated and cross pollinated crops.
 - (a) Introduction and acclimatization.
 - (b) Selection, Mass, Pureline and clonal.
 - (c) Hybridization : Techniques, types, significance and achievements. Back-cross methods of breeding.
 - (d) Breeding for disease pest, frost, drought and lodging resistance.
3. Hybrid vigour (Heterosis) theories and significance.
4. Male sterility and incompatibility.
5. Role of mutations in evolution and plant breeding.
6. Variation in chromosome number. Its role in evolution and plant breeding of crops.
7. Genome analysis, Monosomic analysis, Chromosome substitution and Allelic substitution.
8. A concise account of the plant breeding work done in India on wheat, Maize, Cotton, Sugar cane and potato. Latest evolved varieties suitable for different agro-climatic regions of the country.

SECTION (C)

BIOSTATISTICS

1. Statistics and its application in genetics and agriculture.
2. Introduction to statistical constants : Mean, Mode, Median Deviation, S.D. and S. F.
3. Normal distribution curve, Representation by graphs and Population.
4. Correlation.
5. Analysis of variance, 't' test 'F' test and C.D.

M.Sc. Final

Botany Practical

It will be of 12 hours duration spread over two days and shall carry 200 Marks. The broad distribution shall be as under—

- | | |
|---|---------|
| 1. Taxonomy : Two plants for description. | 12+8=20 |
| 2. Anatomy : Normal or Anomalous structures, one material. | 12 |
| 3. Embryology : Embryo dissection, study of pollen grains and their germination (Vivo & vitro) | 06 |
| 4. One Ecology experiment under field conditions. | 12 |
| 5. One soil Science experiment. | 05 |
| 6. One experiment from Biochemistry. | 20 |
| 7. One experiment from Photobiology. | 05 |
| 8. Seed or flower mixture showing F_2 segregation for Mendelin. ratio or modifications. | 15 |
| 9. Preparation of a twig for hybridization, underfield or lab and the method applied. | 10 |
| 10. An exercise on Biometry or Genetics. | 05 |
| 11. Spots : 1 to 10. | 30 |
| This will be from Marphology. Eco. Botany (2-3) Embryology, Ecology, soil ecology, soil sci. Biochemistry and cytogeneties. | |
| 12. Viva-voce. | 20 |
| 13. Collections and Excursions. | 20 |
| 14. Sessional practical rccord. | 20 |

Total m.m. 200

B.Sc. (Botany) CO1 Diversity of viruses, Bacteria & fungi. This paper includes different types of Bacteria, Fungi & Viruses.

B.Sc. (Botany) CO2 Diversity of Algae, Lichens & Bryophytes. This paper includes study of Algae, Lichens & Bryophytes.

B.Sc. (Botany) CO3: Diversity of Pteridophytes & Gymnosperms- This paper includes study of Pteridophytes & Gymnosperms.

B.Sc. (Botany) CO4 Diversity of Angiosperms: Systematic, Development & Reproduction. It includes flowering plants, classification & Embryology.

B.Sc. (Botany) CO5 Cytology, Genetics, Evolution & Ecology- It includes cell organelles, chromosome, evolution and ecology.

B.Sc. (Botany) CO6 Plant Physiology & Biochemistry- It includes physiology & biochemistry of plants.

B.Sc. (Botany) CO7 Plant resource utilization, Palynology & Biostatistics.- It includes plant importances, pollen details etc.

B.Sc. (Botany) CO8 Molecular Biology & Biotechnology- It includes DNA, RNA Replication, regulation & biotechnology etc.

B.Sc. (Botany) CO9 Environmental Botany & Plant Pathology- It includes pollution of different types, environment, pathology etc.

M.Sc. (Botany) CO1 Phycology & Microbiology- study of Algae & microbes. M.Sc. (Botany)

CO2 Mycology & Plant Pathology- study of fungi & disease.

M.Sc. (Botany) CO3 Bryophyta, Pteridophytes & Gymnosperms- study of Bryophyta, Pteridophytes & Gymnosperms.

M.Sc. (Botany) CO4 Plant Physiology and Crop physiology- Physiology of plant.

M.Sc. (Botany) CO5 Cytology and Molecular Biology- Cell organelles, DNA, RNA, Replication.

M.Sc. (Botany) CO6 Taxonomy, Economic Botany & Morphogenesis- Taxonomy, importance of plants.

M.Sc. (Botany) CO7 Morphology, Anatomy, Embryology & tissue culture- Cellular structure, embryology, tissue culture.

M.Sc. (Botany) CO8 Ecology & Soil Science- Ecology & Soil.

M.Sc. (Botany) CO9 Biochemistry & Photobiology- Biochemistry & Photobiology of plants.

M.Sc. (Botany) CO10 Genetics, Plant breeding & Biostatistics- Genetics, breeding & Biostatistics of plants.

Programme outcomes (Botany)

B.Sc. (Botany) PO1 Understand the plants- Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms.

B.Sc. (Botany) PO2 Understand Viruses, Bacteria, Mycoplasma and other micro- organisms.

B.Sc. (Botany) PO3 Give knowledge of flowering plants and its importance to human life.

B.Sc. (Botany) PO4 Give practical knowledge of Genetics, Biotechnology, Cytology, Angiospermic plants, Molecular Biology etc.

M.Sc. (Botany) PO1 Communicate the effective knowledge of plant physiological processes- photosynthesis, Respiration, Transpiration, Guttation etc.

M.Sc. (Botany) PO2 Give knowledge of practical of Biostatistics, Bioinformatics, physiological processes, ecological, etc. that very important for industrial job.

M.Sc. (Botany) PO3 Give very detailed knowledge of all types of plants i.e. Algae, Fungi, Gymnosperms, Angiosperms, Pteridophytes, Bryophytes, Viruses, Bacteria, Mycoplasma.

Programme specific outcomes (Botany)

B.Sc. (Botany) PSO1 Many competitive examinations can be done after UG.

B.Sc. (Botany) PSO2 Understand basics of plants and apply in many industries of Agricultures, fertilizers etc.

B.Sc. (Botany) PSO3 Knowledge of Genetics, Biotechnology, biostatistics, Cytology etc can help in many industries.

M.Sc. (Botany) PSO1 Minimum Qualification for Scientists in all over Indian Scientific Institutions related to Plant science/Botany

M.Sc. (Botany) PSO2 Can apply for NET/SLET/GATE etc. Lecturer in inter college etc.

M.Sc. (Botany) PSO3 Can apply for teaching posts in Degree/Inter Colleges/Universities.