S.S.JAIN SUBODH P.G. (Autonomous) COLLEGE, JAIPUR
(Affiliated to University of Rajasthan)

SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF SCIENCE

DEPARTMENT OF BOTANY

Bachelor of Science
Subject: Botany
**Semester Structure:** The details of the courses with code, title assign are as given below.

**Duration:** 6 Semesters (3 Years)

**Semester –I**
- BOT 101-Paper-I: Cell biology
- BOT 102-Paper-II: Microbiology
- BOT 103-Paper III: Algae and Lichens
- **BOT P I-Practical: Based on Theory Papers**

**Semester –II**
- BOT 201-Paper-I: Genetics and Plant breeding
- BOT 202-Paper-II: Mycology and Plant Pathology
- BOT 203-Paper III: Bryophyta
- **BOT P II-Practical: Based on Theory Papers**

**Semester-III**
- BOT 301-Paper-I: Molecular Biology
- BOT 302-Paper-II: Biotechnology
- BOT 303-Paper III: Plant Physiology I
- **BOT P III Practical: Based on Theory Papers**

**Semester –IV**
- BOT 401-Paper-I: Pteridophytes
- BOT 402-Paper-II: Gymnosperms and Paleobotany
- BOT 403-Paper III: Plant Physiology II and Biochemistry
- **BOT P IV-Practical: Based on Theory Papers**

**Semester –V**
- BOT 501-Paper-I: Morphology of Angiosperms
- BOT 502-Paper-II: Anatomy of Flowering Plants
- BOT 503-Paper III: Plant Systematics
- **BOT P V-Practical: Based on Theory Papers**

**Semester –VI**
- BOT 601-Paper-I: Reproductive Biology of Angiosperms
- BOT 602-Paper-II Economic Botany and Ethnobotany
- BOT 603-Paper III Ecology
- **BOT P VI-Practical: Based on Theory Papers**
### B. Sc. I Semester
Max. Marks (Theory): 150
(Practical): 75

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Max. Marks (Theory): 150
(Practical): 75

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(Practical): 75

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(Practical): 75

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(Practical): 75

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### B. Sc. VI Semester
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(Practical): 75

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* EoSE- End of Semester Examination
* CIA - Cumulative Internal Assesment
SEMMSTER I
Paper I:  CELL BIOLOGY
Course Code: BOT-101

Max. Marks: 35
30Hrs.

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will
carry one mark for correct answer. Part B of the paper will contain eight questions, out of which
eight questions are to be attempted from each unit with internal choice. Each question will carry 7
marks.

UNIT I:  
7 Hrs.
History of cell and cell theory, microscopy, elementary idea on micrometry and cell
fractionation, characteristics of prokaryotic and eukaryotic cell, chemistry, structure and function
of cell wall and plasma membrane.

UNIT II:  
8 Hrs.
Ultra structure and function of Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi
complex, Peroxisome, Glyoxysome, Ribosome, Vacuoles.

UNIT III:  
7 Hrs.
Detailed structure and function of Nucleus, nuclear envelope, nuclear pore complex and
nucleolus. Chromatin Structure, morphology and organization of chromosomes. Special types of
chromosomes - Sex chromosomes, polypitone and lampbrush chromosomes.

UNIT IV:  
8 Hrs.
Cell cycle and Cell division: Amitosis, Mitosis: different stages, mitotic spindle and chromosome
movement in detail, Meiosis I and II: different stages and its significance, cytokinesis, General
account of chiasmata formation, crossing over, linkage and synaptonemal complex.

Suggested Readings:
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th
- Gupta, P.K. 2009. Cytology, Genetics, Evolution and Plant breeding, Rastogi publication,
  Meerut.
  Wiley and Sons. Inc. New Jersey, USA.
- Lodish, H., Berk, A., Matsudaira, P., Kaiser, C. A., Krieger, M., Scott, P.M., Zipursky,
  publishers, London.
- Verma, P.S. and Agrawal, V.K. 2012. Cell Biology, Genetics, Molecular Biology,
SEMESTER- I
Paper –II: MICROBIOLOGY
Course Code: BOT-102
Max. Marks: 35

Scheme of Examination
30 Hrs
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs.
History and development of Microbiology; contribution of eminent scientists (Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchnikoff, Paul Ehrlich, Alexander Flemming, Selman A. Waksman, Edward Janner), spontaneous generation, biogenesis, germ theory of disease, vaccination and discovery of antibiotics, concept of quorum sensing and biofilms, microbial nutrition and scope of microbiology

UNIT II: 8 Hrs.
General characteristics, occurrence, classification, ultra structure of Bacterial cell: morphology (structure and shapes), flagella, capsule, nutritional types, chromatin material. Reproduction-vegetative, asexual and sexual (transformation, conjugation and transduction), Comparison of Archaeabacteria and Eubacteria, Gram positive and Gram negative Bacteria, Cyanobacteria: Cell structure, reproduction and life history of Nostoc.

UNIT III: 7 Hrs.
Discovery, classification and structural component of Viruses, replication, lytic and lysogenic cycle, Bacteriophages, Structure and reproductive cycle of TMV and Pox virus, Transmission of viruses, Mycoplasma: Occurrence, morphology, reproduction and importance.

UNIT IV: 7 Hrs.
Economic importance of bacteria with special reference to their role in agriculture, industry, waste management and biocontrol. Economic importance of viruses with special reference to vaccine production, role in research and medicine. Probiotics. Basic concept of food spoilage and food preservation.

Suggested Readings:
SEMESTER- I
Paper –III: ALGAE AND LICHENS
Course Code: BOT-103

Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs.
General characters, classification of algae (Fritsch, Smith), diversity in habitat, range of vegetative thallus organization, cell structure photosynthetic pigments and reserve food material. Reproduction: vegetative, asexual and sexual, evolution of sex in algae, types of life cycles.

UNIT II: 8 Hrs.
Chlorophyceae: General characteristics, thallus organization, cell structure, reproduction and life cycle of Chlamydomonas, Volvox, Chara.
Xanthophyceae: General characteristics, Vaucheria: Thallus organization, cell structure, reproduction and life cycle.

UNIT III: 7 Hrs.
Phaeophyceae: General characteristics, Ectocarpus: Thallus organisation, cell structure, reproduction and life cycle.
Rhodophyceae: General characteristics, Polysiphonia: Thallus organisation, cell structure, reproduction and life cycle.

UNIT IV: 7 Hrs.
Economic importance of algae, isolation and culture of algae. Lichens: General characters, types, structure, multiplication, reproduction and economic importance, its importance as colonizers and indicators of environment.

Suggested Readings:
BOTANY PRACTICAL I

Maximum practical Marks = 75 marks
Internal marks = 30 Marks
External marks = 45 Marks

60 HOURS

1. Introduction of handling and maintenance of laboratory equipments.
2. The components, use and care of the bright field compound microscope and dissecting microscope.
3. Calibration of an ocular micrometer for different objectives (Low power & high power).
4. Measurement of cell size (length and breadth) by using ocular and stage micrometer.
5. Demonstration of the phenomenon of protoplasmic streaming in leaf.
6. To study chloroplast, chromoplast and leucoplast in plant material.
7. Isolation of mitochondria from cauliflower.
8. Study of Mitosis in root tip and Meiosis in flower bud from temporary and permanent slides.
9. Study the prokaryotic, eukaryotic cell and cell organelles by electron micro photographs.
10. To study the effect of organic solvent on membrane permeability.
11. Study of the types of bacteria from temporary/permanent slides.
12. Introduction of techniques of slide preparation, stain preparation and staining.
13. Gram’s staining of bacteria from curd.
14. To study sterilization techniques.
15. Preparation of microbiological culture media (potato dextrose agar, nutrient agar).
16. Isolation of bacteria from soil.
17. Measurement of number of microbial cells by the use of haemocytometer.
19. Study of different types of lichens.
SEMESTER- II
Paper –I: GENETICS AND PLANT BREEDING
Course Code: BOT-201

Max. Marks: 35

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 7 Hrs.
Mendel's laws of inheritance- Dominancy, law of segregation, law of independent assortment, deviations from Mendel's laws; interaction of genes, incomplete dominance, codominance, lethal alleles, epistasis, pleotropy, polygenic inheritance (grain color in wheat, corolla length in Nicotiana tabacum) and multiple allelism: ABO blood groups in human.

UNIT II: 8 Hrs.

UNIT III: 8 Hrs.

UNIT IV: 7 Hrs.
Plant breeding: Introduction and objectives of plant breeding , general methods of breeding in- self-pollinated, cross pollinated and vegetative propagated crop plants : Introduction and acclimatization, selections and hybridizations, hybrid vigour and inbreeding depression, green revolution, Role of mutation and polyploidy in plant breeding, national and international agriculture research institute, famous plant breeders and their contribution (Indian and international), Plant breeding work done on wheat and rice in India.

Suggested Readings:
SEMESTER-II  
Paper –II: Mycology and Plant Pathology  
Course Code: BOT-202  
Max. Marks: 35  
30 Hrs

Scheme of Examination 
There will be two parts in end semester theory paper.  
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will  
carry one mark for correct answer. Part B of the paper will consist four questions from each unit  
with internal choice. Each question will carry 7 marks

UNIT I:  
7 Hrs.  
General characteristics, classification (Alexopoulus and Ainsworth’s), thallus, cell structure,  
nutrition, asexual, sexual reproduction, homothallism, heterothallism and heterokaryosis.  
Plant disease: Biotic and abiotic diseases, important symptoms caused by fungi, bacteria, virus  
and MLOs (Blight, mildew, Downy mildew and green ear, rust, smut, canker, mosaic, little leaf,  
gall) etc.

UNIT II:  
7 Hrs.  
General account of class chytridiomycetes, general characteristics, structure and life  
cycles/disease cycles of members of oomycetes and zygomycetes with special reference to the  
genera: Albugo (white rust disease), Sclerospora (Downey mildew/Green ear disease) and  
Pilobolus.

UNIT III:  
8 Hrs.  
General characteristics, structure and life history/disease cycle of class Ascomycetes  
Basidiomycetes and Deuteromycetes with special reference to the genera: Aspergillus,  
Saccharomyces, Claviceps (ergot disease), Peziza, Puccinia (rust disease) and Agaricus.

UNIT IV:  
8 Hrs.  
General characteristics and structure and life cycle of class Deuteromycetes with special  
references to Alternaria (early blight of potato disease), Cercospora and Colletotrichum.  
Parasexual cycle, sex degeneration in fungi and economic importance of fungi.

Suggested Readings:
  New York.  
  Publishing House, New Delhi.  
- Sarabhai, R.C. and Saxena, R.C. 1990. A textbook of Botany. Rastogi publication,  
  Meerut.  
  Delhi.  
SEMESTER- II
Paper –III: BRYOPHYTA
Course Code: BOT-302
Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs.
Bryophytes: General characteristic, origin, evolution, classification (Eichler and Proskauer), habitat range, thallus structure, reproduction, alternation of generation and economic importance.

UNIT II: 7 Hrs.
Habitat, structure, reproduction and life cycle of the following: Hepaticopsida; Riccia and Marchantia.

UNIT III: 7 Hrs.
Habitat, structure, reproduction and life cycle of the following: Anthocерopsida; Anthoceros. Phylogenetic relationship with hepaticopsida and Bryopsis.

UNIT IV: 8 Hrs.
Bryopsida: Habitat, structure, reproduction and life cycle of Funaria and Sphagnum. Sterilisation of sporogenous tissues in Bryophytes.

Suggested readings
BOTANY PRACTICAL II

Maximum practical Marks = 70 marks
Internal marks = 30 marks
External Practical Exam (duration 3 hrs.) = 45 marks

60 HOURS

1. Genetic problems on monohybrid, dihybrid cross, test cross and back cross.
2. Genetic problems on allelic and non allelic gene interactions, multiple alleles, blood group etc
4. Identification of chromosomes on the basis of their size and centomere position.
5. Pedigree analysis for dormant and recessive autosomal and sex linked traits.
6. Study of Barr body in epithelial cells of females.
7. Nuclear staining of filamentous fungi.
8. Preparation of slides and study of following genera through temporary mounts and permanent slides:
   *Albugo, Pilobolus, Aspergillus, Claviceps, Peziza, Puccinia, Ustilago, Agaricus Alternaria*.
9. Study of plant diseased specimens caused by fungi, viruses, bacteria, mycoplasma and nematodes.
11. Survey of structure for defense mechanisms- cuticle, wax, lignin, bark, thron, prickle, trichome.
12. Collection, identification and submission of minimum 3 diseased specimens.
13. Study of habit, habitat, vegetative thallus organization and structure, reproductive structures of the following taxa through temporary mounts and permanent slides:
   *Riccia, Marchantia, Anthoceros, Porella, Funaria, Sphagnum.*
SEMESTER- III  
Paper –I: MOLECULAR BIOLOGY  
Course Code: BOT-301  
Max. Marks: 35  
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper. 
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 7 Hrs
Salient features and structure of DNA and RNA, chemistry of DNA synthesis (Korenberg’s discovery). DNA Replication (prokaryotes and eukaryotes) Synthesis of leading and lagging strands, Okazaki fragments, DNA Polymerases, DNA damage and molecular mechanism of repair.

UNIT II 7 Hrs
Transcription in prokaryotes and eukaryotes (Initiation, Elongation and Termination), Promoter, RNA Polymerases, Transcriptional factors and Inhibitors, attenuation and antitermination, RNA Splicing and processing (concept of introns and exons, removal of Introns).

UNIT III 8 Hrs
Translation (Initiation, Elongation and Termination) in Prokaryotes and Eukaryotes, Genetic code, Translational factors and inhibitors, Operon concept, regulation of gene expression in prokaryotes and eukaryotes. Extra nuclear genome: mitochondria and chloroplast.

UNIT-IV 8 Hrs
Southern, Northern and Western blotting, DNA fingerprinting, polymerase chain reaction, DNA sequencing methods (Sanger’s & Maxam Gilbert Methods), DNA microarrays, Electrophoresis.

Suggested Readings:
SEMESTER- III
PAPER: II : BIOTECHNOLOGY
Course Code: BOT-302

UNIT I:  7Hrs.
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.

UNIT II:  7Hrs.
Protoplast isolation, culture and Somatic cell hybridization, Androgenesis and its importance, Gynogenesis, Somaclonal variation, Somatic embryogenesis, Clonal propagation, Applications of Plant tissue culture,

UNIT III:  8Hrs.

UNIT IV:  8 Hrs.
Medical Biotechnology: Disease diagnosis - Infectious diseases and genetic diseases; Therapeutics-Antisense oligonucleotides, RNAi as therapeutics; Endogenous therapeutics - insulin, somatostatin, interferon’s, vaccines, gene therapy, stem cells and their relevance, Industrial Biotechnology: Large scale production of alcohol and antibiotics.

Suggested Readings:
Scheme of Examination
There will be two parts in end semester theory paper. Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 hrs.
Structure and properties of water, osmosis, water potential and its components, absorption of water, root pressure, pathway of water movement; concepts of symplast and apoplast. Ascent of sap, mechanism of stomatal movements, factor affecting transpiration, it’s theories, mechanism and significance, antitranspirants and guttation.

UNIT II: 8 Hrs.
Transport of ions across cell, mechanism of active and passive transport, translocation of, macro and micro nutrients; role of essential nutrients in plant metabolism and their deficiency symptoms. Outline of Nitrogen and phosphorus cycle. Transamination and deamination.

UNIT III: 7 Hrs.
Photosynthesis, discovery and structure of pigments (chlorophyll and accessory pigment) ,light harvesting units, law of limiting factors. Light reaction- photophosphorylation- (cyclic and non cyclic), dark Reaction- Calvin and Benson cycle, Hatch and Slack pathway, Crassulacean acid metabolism and photorespiration.

UNIT IV: 7 Hrs.
Respiration: Aerobic and anaerobic, glycolysis, tricarboxylic acid cycle, oxidative phosphorylation, and factors affecting oxidative processes, pentose phosphate pathway, fermentation,Cyanide-resistant respiration.

Suggested readings:
BOTANY PRACTICAL III

Maximum practical Marks = 70 marks
Internal marks = 30 marks
External Practical Exam (duration 3 hrs.) = 45 marks

60 HOURS

1. Preparation of Murashige and Skoog (MS) media.
2. Preparation of artificial seeds.
3. Estimation of soluble protein from a selected plant and separation by SDS-PAGE.
4. Isolation of plasmid DNA together from *E. coli*.
5. Demonstration of gel electrophoresis.
6. To determine the water potential of given plant material.
7. Demonstration of phenomenon of osmosis using potato osmoscope.
8. Demonstration of phenomenon of plasmolysis.
9. To determine the osmotic potential of vacuolar sap by plasmolytic method.
10. To study the permeability of plasma membrane using different concentration of organic solvents.
11. To study the effect of temperature on permeability of plasma membrane.
12. To demonstrate root pressure.
14. Study of transpiration rate in dorsiventral and isobilateral leaves by use of potometer.
15. Calculation of the stomatal index, stomatal frequency and percentage of leaf area open through stomata in a mesophyte and a xerophyte.
17. Rate of photosynthesis under varying HCO₃⁻ concentration in an aquatic plant using bicarbonate (Wilmott and Bubbler).
18. Demonstration of O₂ evolution during photosynthesis by inverted funnel method.
19. To study that light is necessary for photosynthesis by using ganong screen.
20. To demonstrate of anaerobic and aerobic respiration.
21. To study that C₀₂, light and chlorophyll is essential for photosynthesis (Moll’s half experiment).
22. Study C³ and C⁴ plant with the kranz anatomy.
23. To study the R.Q. of different substrate by Ganong’s respirometer.
24. Demonstration of O2 evolution during aerobic respiration.
Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs.
Pteridophytes: General account of Pteridophytes, origin, telome theory, classification (G.M. Smith), evolution of stele, development of sporangia (eusporangiate and leptosporangiate) and life cycle patterns of homosporus and heterosporus pteridophytes.

UNIT –II: 7 Hrs.

UNIT-III: 8 Hrs.
General characteristic of Lycophyta and Sphenophyta: Morphology, anatomy and reproduction of Selaginella and Equisetum

UNIT-IV: 7 Hrs.
General characteristics of Filicophyta: Morphology, anatomy and reproduction of Pteridium and Marsilea. Economic importance of Pteridophytes.

Suggested Readings:
SEMESTER- IV
Paper II: GYMNOSPERMS AND PALEOBOTANY
Course Code: BOT-402
Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 7Hrs.
Gymnosperm: General characteristics, distribution, classification (K. R. Sporne, 1965) and economic importance. Brief account of Progymnosperm, affinities of Gymnosperms with Pteridophytes and Angiosperms.

UNIT: II 8Hrs
General characteristics of Cycadales, Coniferales: Morphology, anatomy, reproduction and life cycle with special reference to the genera Cycas and Pinus.

UNIT: III 8Hrs.
General characteristics of Ephedrales: Morphology, anatomy, reproduction and life cycle of Ephedra. Palaeobotany: Geological time scale, fossil types and their formation, technique of study of fossils.

UNIT IV: 7 Hrs.

Suggested Readings:
SEMESTER- IV
Paper –III: PLANT PHYSIOLOGY II AND BIOCHEMISTRY
Course Code: BOT-403

Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 7 Hrs.
Seed dormancy and germination, phases of growth and development; plant movement and biological clock and their regulatory factor.
Growth hormones: Structure, biosynthesis, and physiological role of auxins, gibberellins.

UNIT II: 7 Hrs.
Structure, biosynthesis and physiological role of Cytokinine and Ethylene. Growth inhibitors: Abscisic acid, Brassinosteroids and jasmonic acid.

Physiology of Flowering: Photoperiodism, flowering stimulus, florigen concept, vernalization. Discovery, chemical nature and role of phytochrome in photomorphogenesis and senescence.

UNIT III: 8 Hrs
Carbohydrates: Structure and classification into monosaccharides, oligosaccharides and polysaccharides. Glycoprotein and Glycolipids, Biosynthesis and degradation of sucrose and starch.
Lipids–Structure and classification of lipids, fatty acids- saturated and unsaturated, triacyl glycerols, phospholipids and sphingolipids, fatty acids biosynthesis, oxidation of fatty acids.

UNIT IV: 8 Hrs
Proteins- Amino acids as basic units, structure and classification of proteins (primary, secondary, tertiary and quaternary), conformation and denaturation.
Nomenclature and classification of enzyme feature of active sites substrate specificity, mechanism of action, Michaelis-Menten equation, enzyme inhibition and factor affecting enzyme activity.

Suggested Readings:
BOTANY PRACTICAL IV

Maximum practical Marks = 70 marks
Internal marks = 30 marks
External Practical Exam (duration 3 hrs.) = 45 marks

60 HOURS

1. Double staining technique and technique for preparation of permanent slides.
2. Study of following with the temporary slide preparation and specimens:
   **Pteridophytes:** *Psilotum, Selaginella, Equisetum, Pteridium* and *Marselia* (Vegetative and reproductive).
7. Preparation and applications of Phosphate buffers in biological studies.
8. Principle, working and use of colorimeter and spectrophotometer.
11. Separation of amino acids by paper chromatography and thin layer chromatography.
12. Microchemical tests for carbohydrates (Fehling’s test, Benedict’s test) and proteins (Ninhydrin test, Xanthoproteic test).
13. Separation of chlorophyll and carotenoid pigments by solvent method
16. To study the activity of peroxidase, catalase and amylase enzyme.
17. Estimate chlorophyll and carotenoid content in C3 and C4 plant.
18. To test the presence of ascorbic acid in different plant juices.
SEMESTER- V
Paper –I: MORPHOLOGY OF ANGIOSPERMS
Course Code: BOT-501
Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT 1: 7 Hrs
Plant habit, the basic plan of flowering plants, modular types of growth, diversity of plant form in annuals, biennials and perennials, evolution of tree habit in gymnosperm, monocotyledons and dicotyledons, trees largest and longest lived plants.

UNIT II: 8 Hrs.
Root: Structure of root, types and structural modification for storage, physiological and mechanical, interaction of root with other microorganisms.
Stem: Structure, types and modification (storage and mechanical), branching pattern, monopodial and sympodial growth, canopy architecture.

UNIT III: 7 Hrs.
Leaves: Origin, development, types, phyllotaxy, venation, lamina parts, shapes, size and modifications, leaf surface features and appendages, leaf surface area, stomata and trichome structure.

UNIT IV: 8 Hrs.
Flower: Flower as a modified shoot, detailed structure of flower, types of inflorescence and specialized inflorescence, fruit Structure, types and classification, detail structure of seed and seed coat (monocot and dicot), significance of seed, suspended animation, ecological adaptation, dispersal strategies.

Suggested readings:
SEMESTER- V
Paper –II: ANATOMY OF FLOWERING PLANTS
Course Code: BOT-502

Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs.
Classification and structure of tissues; Simple tissue: Structure occurrence and function (parenchyma, collenchyma, sclerenchyma), Complex tissues: Structure, origin and function (xylem and phloem), tissue systems, Secretary tissues: Glands, glandular hairs, nectaries, hydathodes, schizogenous and lysigenous ducts, resin ducts, mucilage ducts and laticifers. Vascular bundle: Types (conjoint, collateral, bi-collateral, open closed, radial, concentric: amphicribal and amphivasal).

UNIT II: 7 Hrs.
Meristem definition, classification, types and function, Shoot apical meristem theories: Apical cell theory, histogen theory, tunica-corpus theory, continuing meristematic residue, cytohistological zonation. Root apical meristem theories: Apical cell theories, histogen theory, korper-kappe theory, quiescent cell theory,

UNIT III: 7 Hrs.

UNIT IV: 8 Hrs.

Suggested readings:
SEMESTER- V
Paper –III: PLANT SYSTEMATICS
Course Code: BOT-503

Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 7 Hrs.
Scope and importance of taxonomy, history and classification of angiosperm (Linnaeus, Bentham and Hooker and Engler and Prantl), brief reference of angiosperm phylogeny group (APGIII) classification, concept of species, genus and family. Taxonomic tools: Herbarium, E-Flora, botanical garden, monograph, library index, journals, key and icons.

UNIT II: 7 Hrs.
Principle and rules of botanical nomenclature: Ranks, names, type method, author citation, valid publication, principle of priority and its limitations. Taxonomic evidences from cytology, phytochemistry, embryology and taximetric. Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly and polyphyly

UNIT III: 8 Hrs.
Taxonomic studies of the following families (Bentham and Hooker), Dicots: Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Myrtaceae, Fabaceae, Apiaceae, Asteraceae, Apocynaceae and Asclepidaceae.

UNIT IV: 8 Hrs.
Taxonomic studies of the following families (Bentham and Hooker): Solanaceae, Convolvulaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Arecaceae, Liliaceae, Orchidaceae and Poaceae.

Suggested readings:
BOTANY PRACTICAL V

Maximum practical Marks = 70 marks
Internal marks = 30 marks
External Practical Exam (duration 3 hrs.) = 45 marks

1. Study of different modifications of root, stem, leaf by using specimens.
2. Study of different epidermal appendages (trichome etc.) by making slides.
4. Survey and study of dispersal mechanism of seeds.
5. Microscopic studies on types and anatomy of stomata (monocotyledons and dicotyledons).
6. Study of apical and lateral meristem using plant material and slides
7. Anatomical study of root, stem and leaf (dicotyledons and monocotyledons) by making double stained temporary and permanent slides.
8. Anatomical studies of anomalous secondary structure in stem of *Mirabilis, Bignonia, Borhavia, Nyctanthus, Salvodora, Leptadenia, Dracena* by making temporary and permanent slides.
9. Anatomical study of dicot and monocot seed (Cicer, Maize and cotton)
10. Study of vegetative and floral characters of species of the families studied in theory.
11. Identification of selected taxa up to genus using taxonomic keys.
12. Herbarium technique.
SEMESTER- VI  
Paper –I: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS  
Course Code:  BOT-601  

Max. Marks: 35  
30 Hrs

Scheme of Examination  
There will be two parts in end semester theory paper.  
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I:  
Typical angiosperm flower, structure of anther, microsporogensis, microgametogenesis, palynology and scope. Pollen wall protein; pollen viability and abnormal features; polyads, masslae, pollinia.

UNIT II:  
Structure and types of ovule, special structures- aril, oburator etc., megasporogenesis, megagametogenesis (monosporic, bisporic and tetrasporic types), structure of typical embryo sac, (Polygonum, Allium and Adoxa type).

UNIT III:  
Pollination types, significance adaptations; compatibility and incompatibility; basic concepts. Pollen tube entry, syngamy and triple fusion, double fertilization, development, type and function of endosperm.

UNIT IV:  
Six types of Embryogeny; General pattern of development of dicot and monocot embryo; suspensor structure and function, embryo-endosperm relationship; nutrition of embryo, apomixis, polyembryony, fruit-development and maturation.

Suggested Readings  
SEMIESTER- VI
Paper –II: ECONOMIC BOTANY AND ETHNOBOTANY
Course Code: BOT-602
Max. Marks: 35
30 Hrs

Scheme of Examination
There will be two parts in end semester theory paper.
Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions, out of which four questions are to be attempted from each unit with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs
Centre of origin of cultivated plants (Vavilov), secondary centre of origin. History, origin, distribution, botany, cultivation and processing of cereals: wheat, maize, rice and bajra. General account of pulses: chana and moong. Identification and medicinal value of locally available medicinal plants (only five).

UNIT II: 8 Hrs.
General account and identification of spices and condiments (any five) of Rajasthan. Characteristics and uses of timber yielding plants teak and sal, dyes (Indigo and Lawsonia), beverages (tea and coffee), fumigatories and masticatories, fat and oil yielding plants (Brassica and Cocus).

UNIT III: 8 Hrs.
General account and identification of locally available fruits, vegetable and ornamental plant. History, cultivation, processing and economic use of sugar and rubber, fiber yielding plants (cotton and jute).

UNIT IV: 6 Hrs.
Ethnobotany and its concepts and relevance. Ethnobotanical areas of Rajasthan, ethnic groups in India and ethnobotanical study of any tribal area of Rajasthan. Ethical aspect of ethnobotany.

Suggested Readings
Scheme of Examination

There will be two parts in end semester theory paper. Part A of the paper shall contain seven short answer questions of 7 marks. Each question will carry one mark for correct answer. Part B of the paper will contain eight questions out of which four questions to be attempt with internal choice. Each question will carry 7 marks.

UNIT I: 8 Hrs.
Environment and plant: Ecological factors; Atmosphere (four distinct zone), light (photosynthetically active radiation, zonation in water bodies, photoperiodism, heliophytes and sciophytes), temperature (Raunkier’s classification of plant: megatherm, mesotherm, microtherm, heikistotherm, thermoperiodicity and vernalisation), soil (development, soil profile, properties). Ecological adaptations of hydrophytes, xerophytes, epiphytes and halophytes. Population ecology: growth curve, ecotypes, ecads. Population interaction among organisms (neutralism, amensalism, alleliopathy), competition, predation, parasitism and mutulism.

UNIT II: 7 Hrs.
Community characteristics, frequency, density, cover, life forms, biological spectrum, ecological succession. Ecosystem: Structure, components, food chain, food web, energy flow, trophic levels and ecological pyramids, primary and secondary productivity, biogeochemical cycle of carbon and phosphorus.

UNIT III: 7 Hrs.
Biogeographic regions of India, vegetation types of India; forest grassland with special reference to Rajasthan. Environmental pollution- air, water and soil, WWF, chipko movement, green house effect, ozone depletion loss of biodiversity and extinction of species, red data book.

UNIT IV: 8 Hrs.
Concept and principles of environmental management, principle of optimized use and sustainable development, threats to sustainable development, ecological footprint, National Environmental Policy, management of forest and degraded lands, concepts and principles of environmental management, efforts to control these effects (Vienna Convention, Montreal Protocol, Earth summit, Kyoto Protocol, World Summit on sustainable development, 2002 Carbon trade); IPCC.

Suggested Readings:

BOTANY PRACTICAL VI

Maximum practical Marks = 70 marks
Internal marks = 30 marks
External Practical Exam (duration 3 hrs.) = 45 marks

1. Study different types of placentation, ovules and special structures of ovule through permanent slides, specimens or photographs.
2. Study of female gametophyte through permanent slides/photographs: types and ultrastructure of mature embryo sac.
3. Study of pollen grains: fresh and acetolyzed showing ornamentation and aperture, pseudomonads, pollinia (slides/photographs/ fresh materials).
4. Study of the different stages of anther development.
5. Study of pollen morphology of available plants.
6. Pollen germination test-
   a. *In vitro* germination using sugar solution
   b. Tetrizolium test
7. Study of monocotyledons and dicotyledons embryo of angiosperms through slides/photographs.
8. Dissect and display embryo at various developmental stages using mustard seeds.
9. Dissection of developing seeds for endosperm with free nuclear haustoria.
10. Submission of economically important plants and plant products (cereals, pulses, spices, fibers, condiments, fat and oils, tea, coffee, wood, dyes, tobacco).
11. Study following specimens with special reference to:
    1. Botany of the economically important part.
    2. Processing if any involved.
    3. Specimens of cereals, pulses, fibres, spices, beverage (tea, coffee), sugar, oil yielding plants and medicinal plants (mentioned in theory).
13. Study of starch grains in potato and pea.
14. Field trip to economically important place.
15. Collection, description and submission of at least 5 plants of ethnobotanical importance.
16. Study of adaptive anatomical and morphological features of Hydrophytes, Epiphytes and Xerophytes using plant material.
17. Study of soil pH, soil moisture in relation to depth, bulk density, porosity and water holding capacity of different soil samples.
18. Determination of requisite size and number of quadrat for the study of plant community
19. Study of structure of plant community by determining frequency, density and abundance of quadrat method.
20. To study different statistical methods: mean, median and mode, standard error, standard deviation.
21. Regression analysis and application of statistical tests in environmental problems.
22. Find out transparency of a water body by secchi disc.
23. Determine the dissolved oxygen content in polluted and unpolluted water samples.
24. Field trip to a National Park/Biosphere reserve/Wild life Sanctuary (Student should submit a detailed project report based on the field trip. Evaluation of the project will be based on the detailed report and presentation).

25. Project work on a particular ecosystem/Polluted Site/Level of Pollution in the City or Town/Land use site.