Annexure-I

Batch : 2015-onwards

HIMACHAL PRADESH UNIVERSITY SHIMLA-171005

CHOICE BASED CREDIT SYSTEM
(CBCS)-B.Sc. Botany (Major)

Syllabus and Examination for B.Sc. Botany (Major)

Under CBCS

Semester System

June 2016 (IIIrd semester- onwards)
Phycology, Mycology and Plant Pathology Credits = 3

Course duration- 40 Hours UNIT-I

Phycology

Subunit-A: General characters, classification up to orders (Fritsch 1945) and economic importance. _______02 Hours

Subunit-B: Important features and life history (excluding development) of Nostoc (Cyanophyceae), Oedogonium (Chlorophyceae), Vaucheria (Xanthophyceae), Diatoms (Bacillariophyceae), Ectocarpus (Phaeophyceae) and Polysiphonia (Rhodophyceae). Pigment constitution of the above mentioned classes. ________12 Hours

UNIT-II (Mycology)

Subunit-C: General characters, classification up to orders (Alexopoulos and Mims1979) and economic importance.________ 03 Hour

Subunit-D: Important features and life history (excluding development) of Albugo (Mastigomycotina) Rhizopus (Zygomycotina), Saccharomyces, Neurospora (Ascomycotina), Agaricus (Basidiomycotina) and Colletotrichum (Deuteromycotina). _______ 13 Hour

Subunit-E: Lichens (Lichen components and their nature of association; Occurrence; Classification by Hole 1967; Morphology and anatomy of thallus; Special vegetative structures associated with lichen thallus; Reproduction; Ecological and Economic importance). ________ 03 Hours

UNIT-III (Plant Pathology)

Subunit-F: Definitions, symptoms, classification and etiology of following diseases: Late blight of potato, Apple scab, Loose smut of wheat, Black stem rust of wheat, Early blight of potato, Citrus canker; General account of plant disease control (Quarantine, Chemical, Biological and Integrated); losses caused by plant diseases. _______07 Hours
PRACTICAL Code: BSCBOT 0101(P)

Phycology, Mycology & Plant Pathology

Credit = 1

1. Study of some laboratory techniques (Whole mounts, Maceration, Smearing, Section cutting, Squash, Light microscopy, Digital image projection and Micrometry).

2. Preparation of Fixing agents (Carnoy's fluid, Formalin-Aceto-Alcohol), Stains (Acetocarmine, Aniline blue, Crystal violet, Fast green, Safranin, Gram's iodine); Grades of Ethanol, Clearing agents and Mounting media (Glycerine jelly, Lactophenol, DPX and Canada balsam).

3. Preparation of Temporary stained mounts of type specimens (Whole mounts, teased mount) as mentioned in theory paper.

Suggested Readings

- **Phycology**:

- **Mycology**:

- **Plant Pathology**:

Code: BSCBOT0102
Bryophyta and Pteridophyta

Credits = 3

Course duration- 40 Hours

UNIT- I (Bryophyta)

Subunit-A: General characters, classification up to orders (Proskauer 1957); Economic and Ecological importance. ______ 04 Hours

Subunit-B: Morphology, anatomy, reproduction (excluding development) and life history of Marchantia, Porella, Anthoceros, Sphagnum and Funaria. ______ 15 Hours

UNIT- II (Pteridophyta)

Subunit-C: General characters, classification up to order (Sporne 1975); Evolution of stele; Brief account of Apogamy and Apospory; Study of fossil plant Rhynia. _________ 06 Hours

Subunit-D: Morphology, anatomy, reproduction (excluding development) and life history of Psilotum, Selaginella, Equisetum, Adiantum and Marsilea. _________ 15 Hours

PRACTICAL Code: BSCBOT 0102(P)

Bryophyta & Pteridophyta

Credit = 1

1. Study of morphology, anatomy and reproduction of type specimens as mentioned in theory paper.

2. Section cutting procedure of Bryophyta and Pteridophyta specimens.

3. Preparation of Double stained permanent mount of Pteridophyta sections.

Suggested Readings

01. Bryophyta:

02. Pteridophyta:

Semester-II

Code: BSCBOT0203
Palaeobotany and Gymnosperms

Credits = 3

Course duration- 40 Hours

UNIT- I (Palaeobotany)

Subunit-A: Fossils and fossilization process; Type of fossils and their importance; Contribution of Prof. (Dr.) Birbal Sahni. _______ 09 Hours

Subunit-B: Reconstruction of fossil plant *Lyginopteris*; Geological Time Table (up to period level with characteristic plant life); Evolution of seed habit. _______ 09 Hours

UNIT-II (Gymnosperms)

Subunit-C: General characters, Classification up to order (Pilger and Melchior's 1954); Economic importance. _______ 05 Hours

Subunit-D: Morphology, anatomy, reproduction and life history of *Cycas*, *Pinus*, and *Ephedra*. _______ 17 Hours

a. Teacher is supposed to prevent students, collecting any type of plants and submitting them in the form of Herbarium for the practical examination, as this practice is destroying the flora and fauna. Instead, the students should be asked to prepare field reports.

b. Teacher should accompany the students for field visit (College campus, local visit, college education tour to Botanical garden).

c. Field visit is ESSENTIAL PART OF THE COURSE.

PRACTICAL

Code: BSCBOT 0203(P)

Palaeobotany & Gymnosperms

Credit = 1

1. Study of morphology, anatomy and reproduction of type specimens as mentioned in theory paper.

2. Preparation of Double stained permanent mount of Gymnosperm sections.

3. Study of Palaeobotany using models, images or rock specimens.

Suggested Readings

01. Palaeobotany:


02. Gymnosperms:

Code: BSCBOT0204

Plant Taxonomy and Selected Families of Angiosperms

Credits = 3

Course duration: 40 Hours

UNIT- I (Plant Taxonomy)

Subunit-A: Angiosperms origin and evolution; Taxonomy and Systematics; Aim of taxonomy; Functional components of taxonomy (Alpha, Beta and Omega taxonomy).

   __ 02 Hours

Subunit-B: Binomial nomenclature, principles and rules; Principle of priority; Role of Chemotaxonomy, Cytotaxonomy and Taximetrics in relation to taxonomy; Type concept and keys to identification of plants; Basic idea of Herbarium preparation and its significance; Botanical gardens and their role (Royal Botanic Garden, Kew England, Indian Botanic Garden, Calcutta and National Botanic Garden, Lucknow).

   ______ 08 Hours

Subunit-C: Differences among Artificial, Natural and Phylogentic system of classification; Phylogenetic (Evolutionary) principles; Salient features of the systems of classification of Angiosperms proposed by Bentham & Hooker and Engler & Prantl.

   ______ 05 Hours

UNIT-II

(Selected Families of Angiosperms)

Subunit-D: Floral terminology and type of inflorescence.

   ______ 03 Hours

Subunit-E: Floral diversity, diagnostic features and economic importance of following families:

01. Ranunculaceae (Ranunculus)
2. Brassicaceae / Cruciferae (Brassica)
3. Malvaceae (Hibiscus)
4. Rutaceae (Citrus)
5. Fabaceae / Leguminosae (Caesalpinioideae: Cassia; Faboideae: Pisum; Mimosoideae: Acacia)
6. Cucurbitaceae (Cucurbita)
7. Apiaceae / Umbelliferae (Coriandrum)
8. Asteraceae / Compositae (Helianthus)
9. Asclepiadaceae (Calotropis)
10. Solanaceae (Solanum)
11. Lamiaceae / Labiatae (Salvia)
12. Euphorbiaceae (Euphorbia)
13. Liliaceae (Allium)
14. Poaceae / Gramineae (Triticum)
15. Orchidaceae (Zeuxine) ___________________ 22 Hours

Note to Teachers:

1. Teacher will demonstrate the methodology of Herbarium preparation.
2. Teacher is supposed to prevent students, collecting any type of plants and submitting them in the form of Herbarium for the practical examination, as this practice is destroying the flora and fauna. Instead, the students should be asked to prepare field reports.
3. Teacher should accompany the students for field visit (College campus, local visit, college education tour to Botanical garden).
4. Field visit is ESSENTIAL PART OF THE COURSE.

PRACTICAL

Code: BSCBOT 0204(P)

Plant Taxonomy and Selected Families of Angiosperms

Credit = 1

1. Study of root, stem and leaf morphology.
2. Study of inflorescence.

Suggested Readings

- Plant Taxonomy and Selected Families of Angiosperms:
Semester-III

Code: BSCBOT0305

Economic Botany and Plant Anatomy

Credits = 3

Course duration- 40 Hours

UNIT- I (Economic Botany)

Subunit-A: Brief account about the centres of origin of major economic crops (Rice, Wheat, Maize, Potato, Sugarcane, Mustard, Cotton and Rubber); Knowledge about location of National and International agricultural research centres or institutes of Rice, Wheat, Maize and Potato. _____03 Hours

Subunit-B: Distribution, botanical description and brief idea of cultivation and uses of the following:


Subunit-C: Spices (Listing of common spices, their Botanical names, families and part used); Timber yielding plants of India with emphasis on Himachal Pradesh (Write only the Botanical names, families, occurrence and few words about wood properties). _____04 Hours

UNIT- II (Plant Anatomy)

Subunit-D: Diversity in plant forms-annuals, biennials and perennials; Meristematic and permanent tissues (simple and complex). _____03 Hours

Subunit-E (The Shoot System): Shoot apical meristem and theories about its histological organizations (Monocot and Dicot); Structure of primary monocot (Maize) and dicot stem (Sunflower); Secondary growth in dicot stem; Cambium structure and functions; Characteristics of growth rings; Sap wood and heart wood; Periderm; Anomalous secondary growth with reference to Dracaena and Boerhaavia. _____05 Hours

Subunit-F (Leaf): Type of leaves; Phyllotaxy and venation pattern; Anatomy of typical Monocot (Grass / Maize) and Dicot leaf (Sunflower); Examples of cell inclusions in leaves; Stomatal apparatus and their morphological types. _____05 Hours

Subunit-G (The Root System): Root apical meristem and theories about histological organization (Monocot and Dicot); Secondary growth in dicot root; Structural modifications in roots with reference to Beta (storage), Rhizophora (respiratory), Vanda (epiphytic) and root nodules of Leguminous plant (Interaction with microbes). _____05 Hours
PRACTICAL

Code: BSCBOT 0305(P)

Economic Botany & Plant Anatomy

Credit = 1

1. Study of Economic Botany specimens as mentioned in theory paper.
2. Anatomy of Angiosperms as mentioned in theory paper.
3. Section cutting and preparation of double stained permanent mounts.

Suggested Readings

01. Economic Botany:
      New Delhi.
   b. Sharma, O.P. 1996. Hills Economic Botany (Late Dr. A.F. Hill adapted by

02. Plant Anatomy:
      Rastogi Publications.
      approach). Blackwell Publishing.
   h. Rudall, P.J. 2007. Anatomy of Flowering Pants (an introduction to structure
Code: BSCBOT0306

Embryology of Angiosperms Credits = 3

Course duration- 40 Hours

UNIT- I

Subunit-A: Contribution of Prof.(Dr.) Panchanan Maheshwari; Flower a modified shoot; Functions of various floral parts. _______ 05 Hours

Subunit-B: Microsporangium, its wall and dehiscence mechanism; Microsporogenesis, pollen grains and detailed account of its structure; Pollen aperture type and NPC system; Pollination (types and agencies); Pollen-pistil interaction; Self incompatibility; Pollen germination and development of male gametophyte. _______ 12 Hours

UNIT-II

Subunit-C: Structure of Megasporangium (Ovule); Megasporogenesis and Megagametogenesis (Development of female gametophyte); Examples of female gametophyte (Monosporic, bisporic and tetrasporic); Double fertilization; Endosperm types and its biological importance; Embryogenesis in dicot (Capsella) and monocot (Sagittaria); Polyembryony; Apomixis (Vegetative reproduction and Agamospermy. _______ 17 Hours

Subunit-D: Structure of dicot and monocot seed; Fruit types; Dispersal mechanism in fruits and seeds. _______ 06 Hours

PRACTICAL

Code: BSCBOT 0306(P)

Embryology of Angiosperms

Credit = 1

1. Morphological and Anatomical study of floral parts.
2. Study of pollination behaviour.
3. Morphological study of fruit, seed and their dispersal mechanisms.
4. Study of monocot, dicot embryo and testing their viability by NTC test.

Suggested Readings • Embryology of Angiosperms:

Semester-IV

Code: BSCBOT0407

Cytogenetics

Credits = 3

Course duration- 40 Hours

UNIT-I

Subunit-A (Mendelian Genetics): Biography of Gregor Johann Mendel; Mendel's experiments on garden pea; Laws of dominance, Segregation, and Independent assortment; Modern genetic terminology. ________ 5 Hours

Subunit-B (Extensions of Mendelian Genetics): Chromosomal basis of Mendelism; Concept of Linkage and Crossing over; Genetic recombination; Brief idea about chromosome mapping in eukaryotes; Karyotype; Allelic and non-allelic interactions; Multiple alleles; Brief account of Quantitative inheritance. ________ 09 Hours

Subunit-C: (Chromosomal alterations / Mutations): Variations in chromosome structure (Deficiencies, Deletions, Duplications, Translocations, Inversions and Position effects); Giant Polytenes in Diptera; Variations in chromosome numbers (Aneuploidy and Polyploidy); Sex chromosomes. ________ 09 Hours

UNIT-II

Subunit-D (Genetic Material): DNA as the genetic material, DNA structure and replication; DNA-Protein interaction Satellite and repetitive DNA. ________ 05 Hours

Subunit-E (Gene Expression): Modern concept of gene; RNA structure (m-RNA, t-RNA); Ribosome structure; Flow of genetic information; Genetic code; Mechanism of protein synthesis; Gene mutations; Regulation of gene expression in prokaryotes and eukaryotes. ________ 09 Hours

Subunit-F (Extra Nuclear Inheritance): Presence and function of Mitochondrial and Plastid DNA; Plasmids. ________ 03 Hours

PRACTICAL

Code: BSCBOT 0407(P)

Cytogenetics

Credit = 1

1. Determination of probability by tossing coins.
2. Demonstration of phenomenon of Segregation.
3. Demonstration of phenomenon of Independent assortment.
4. Study of Cytoplasmic inheritance in *Mirabilis jalapa*.
5. Study of various genetic aspects with the help of models or images.
**Suggested Readings**

**Cytogenetics:**


**Code: BSCBOT0409**

**Cell Biology**

**Credits = 3**

**Course duration- 40 Hours**

**UNIT-I**

**Subunit-A (Overview of Cells):** Cell theory; Prokaryotic and Eukaryotic cells. **________ 02 Hours**

**Subunit-B (Chemistry of the Cell):** Chemical and physical properties of water; Importance of water; Basics of macromolecules (Carbohydrates, Proteins, Lipids and Nucleic acids). **________ 04 Hours**

**Subunit-C (Brief account of Basic Techniques used in Cell Biology):** Principles of fixation and type of fixatives; Embedding; Staining methods; Resolving power and magnification of microscope; Differences between light and electron microscope and their types (Bright field, Dark field, Phase-contrast, Fluorescence, TEM and SEM); X-ray diffraction; Autoradiography; Cell fractionation; Methods of studying microorganisms. **________ 08 Hours**

**UNIT- II**

**Subunit-D (Viruses and Bacteria):** General account and classification of viruses; Structural detail of TMV, HIV and ^-Bacteriophage; General account of Mycoplasma; Detailed ultra structure nutrition, reproduction and economic importance of bacteria. **________ 08 Hours**

**Subunit-E (Eukaryotic Cell Structure):** Ultrastructure, chemical composition and functions of cell wall and plasma membrane; Ultrastructure, chemical composition and functions of Nucleus, Mitochondria, Chloroplast, Golgi bodies, Endoplasmic reticulum, Ribosomes, Lysosomes, Peroxisomes, cytoskeleton and Vacuole. **________ 10 Hours**

**Subunit-F (Chromosomes and Cell Division):** Packaging of DNA in chromatin and chromosomes (Nucleosome model); Type of chromosomes on the basis of centromere position; Cell cycle and its regulation; Mitosis and Meiosis; Significance of cell division; Apoptosis; General account of Cancer and its molecular basis. **________ 08 Hours**
PRACTICAL

Code: BSCBOT 0409(P)

Cell Biology

Credit = 1

1. Study of some laboratory techniques (Maceration, Smearing, Squash and Micrometry).
2. Preparation of Fixing agents (Carnoy's fluid, Formalin-Aceto-Alcohol), Stains (Acetocarmine, Aniline blue, Crystal violet, Fast green, Safranin, Gram's iodine) and Mounting media (Glycerine jelly, Lactophenol).
3. Study of Mitosis by preparing Acetocarmine squash of onion root tip.
5. Study of instrumentation used in Cell Biology (Equipment or Equipment image).

Suggested Readings

• Cell Biology:


Semester-V

Code: BSCBOT0510

Biochemistry

Credits = 3

Course duration - 40 Hours

UNIT- I

Subunit A (Thermodynamic Principles): First law of thermodynamics; Second law of thermodynamics; Concept of free energy and chemical equilibrium. _______ 03 Hours

Subunit B (Chemical Foundations): pH scale; Acids, Bases and Buffers; Weak interactions (Hydrogen bonds, Ionic interactions, Hydrophobic interactions and Vander Waal interactions); _______ 09 Hours

Subunit C (Basics of Enzymology): Discovery and characteristics of enzymes; International classification of enzymes; Important terms in Enzymology (Enzyme unit, Specific activity and Turnover number); Proenzymes; Concept of holoenzyme, apoenzyme, coenzyme and cofactors; Mode and mechanism of enzyme action; Enzyme kinetics (Michaelis-Menten equation); Enzyme inhibition (Competitive, Noncompetitive and Uncompetitive); Brief account of regulatory enzymes and Isoenzymes. _______ 12 Hours

UNIT- II

Subunit D (Carbohydrate Metabolism): Aerobic and anaerobic respiration; ATP as Biological energy currency; Glycolysis, Gluconeogenesis, Krebs cycle and Electron transport mechanism; Redox potential; Mechanism of oxidative phosphorylation (Chemo-osmotic theory); Pentose phosphate pathway. _______ 08 Hours

Subunit E (Lipid Metabolism): Saturated and unsaturated fatty acids; Fatty acid biosynthesis; Alpha and Beta oxidation. _______ 03 Hours

Subunit F Protein Metabolism): Transamination; Deamination; Biology of nitrogen fixation; Importance of Nitrate reductase; Ammonium ion assimilation. _______ 05 Hours
PRACTICAL

Code: BSCBOT 0510(P)

Biochemistry

Credit = 1

1. Study of lab safety.
2. Qualitative analysis of Amino acids, Proteins, Carbohydrates, Lipids and Nucleic acids.
3. Demonstration of enzyme activity (Alpha-amylase, Invertase, Protease and Catalase) from plant or animal sources.
5. Study of equipments used in Biochemistry (Equipment or Equipment image).

Suggested Readings

- Biochemistry:

Code: BSCBOT0511

Biotechnology

Credits = 3

Course duration - 40Hours

UNIT- I

Subunit A (Introduction to Biotechnology): Some selected definitions; Historical development of biotechnology; Traditional biotechnology; Modern biotechnology; Biotechnology as an interdisciplinary pursuit; Scope and importance of biotechnology; Biotechnology in India and global trends. _______06 Hours

Subunit B (Genetic Engineering Methods): Aim of genetic engineering in biotechnology; Vectors and Restriction enzymes; Technique of making Recombinant DNA; Polymerase chain reaction; DNA fingerprinting. _______11 Hours

UNIT- II

Subunit C (Plant Biotechnology): Historical background; Organization of plant tissue culture laboratory; Common type of culture media (MS, B5 and White's media) and their composition; Maintenance of aseptic conditions; Cell culture; Cellular totipotency; Somatic embryogenesis; Haploid production; Somatic hybridization and Cybridisation; Gene transfer techniques using Agrobacteriumtumefaciens, electroporation and micro projectile gun; Transgenic plants for crop improvement; Cryopreservation. _______13 Hours

Subunit D (Industrial and Microbial Biotechnology): Required laboratory facilities; Techniques of microbial culture; Procedures of microbial culture; Types of microbial culture; Measurement of microbial growth; Fermentation; Vessels for microbial culture
(Baffle flasks, shakers, fermenters); Microbial products (Primary and Secondary metabolites); Downstream processing; Single cell protein (SCP); Biofertilizers; Biopesticides; Outline of Hybridoma technology and production of monoclonal antibodies._________10 Hours

PRACTICAL

Code: BSCBOT 0511(P)

Biotechnology

Credit = 1

1. *Demonstration of Equipments:* Spectrophotometer; Centrifuge; Electrophoresis unit; pH meter; Water bath; Incubator; Hot air oven; Shaker; Magnetic stirrer; Test tube shaker; Heating plate; Distillation plant; Autoclave; Laminar air flow; PCR; Analytical digital balance; Single-pan balance; Good quality microscope with projection system.
2. Sterilization techniques (Physical and Chemical methods).
5. Gram staining of Bacteria.
6. Isolation of milk proteins.
7. Cell viability assay by FDA and Evan's Blue method.
8. Preparation of MS medium for tissue culture

*Subject to the availability of lab facilities. Teacher may demonstrate with the help of images.

Suggested Readings

- Biotechnology:
Semester-VI

Code: BSCBOT0613

Ecology

Credits = 3

Course duration - 40 Hours

UNIT-I

<table>
<thead>
<tr>
<th>Subunit</th>
<th>Description</th>
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<tbody>
<tr>
<td>A</td>
<td>(Introduction to Ecology): History of ecology; Definition, scope and importance; Ecology as synthetic discipline.</td>
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<tr>
<td>B</td>
<td>(Environmental Factors): Climatic; Topographic; Biotic (species interactions); Fire and Edaphic (soil profile, physicochemical properties); Soil erosion and conservation.</td>
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<tr>
<td>C</td>
<td>(Biogeochemical Cycles): Carbon; Nitrogen; Phosphorous; Sulphur andHydrological cycle.</td>
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<tr>
<td>D</td>
<td>(Adaptations of Plants to Water and Salinity): Morphological and anatomical features of Hydrophytes, Xerophytes and Halophytes.</td>
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<tr>
<td>E</td>
<td>(Law of Liebig, Shelford and Limiting factors): Liebig's law of minimum; Shelford's law of tolerance; combined concept of limiting factors; Importance of limiting factors.</td>
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<tr>
<td>F</td>
<td>(Population Ecology): Introduction; Population characteristics, Genecology (Ecads, ecotypes and ecospecies).</td>
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<tr>
<td>G</td>
<td>(Community Ecology): Introduction; Qualitative, Quantitative and Synthetic characteristics; Methods of analysis.</td>
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UNIT-II

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<tr>
<th>Subunit</th>
<th>Description</th>
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<tbody>
<tr>
<td>H</td>
<td>(Ecological Succession): Concept of climax; Type of succession, features and causes; detailed account of Hydrosere and Xerosere.</td>
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<tr>
<td>I</td>
<td>(Ecosystem Ecology): Structure (components) and functions (trophic levels, food chains, food webs, ecological pyramids and energy flow).</td>
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<tr>
<td>J</td>
<td>(Phytogeography): Definitions; Outline of Phyto-geographical regions of world and India; Botanical regions of India; Vegetation types of India.</td>
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<tr>
<td>K</td>
<td>(Environmental Pollution): Environmental pollutants; Kinds of pollution (Air, water, solid waste,noise and radioactive); Biomagnification; Cost of pollution; General account of Toxicology and Ecotoxicology.</td>
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<td>L</td>
<td>(Climate Change): Greenhouse effect and its impact; Carbon trading; El Nino and La Nina effects; Ozone layer depletion and its impact.</td>
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</tbody>
</table>
1. Study the physical characteristics (Temperature, colour and texture) of the soil sample.
2. Determination of water holding capacity of the soil.
3. Determination of field capacity of the soil.
4. Study the chemical characteristics of the soil (Test the soil for Moisture content, Chloride, Nitrate, Carbonate, Phosphate, Sulphate, Potassium and Phosphorous).
5. Determine the base deficiency and pH of the soil sample.
6. Recording of temperature, relative humidity, light intensity, wind speed and rainfall of the atmosphere.
7. Determination of the minimum size of the quadrant by Species-Area-Curve method.
8. Determination of density, abundance and frequency of species by quadrant method.
10. Measurement of water quality, based on dissolved oxygen and free carbon dioxide levels in water samples.
11. Morphological and anatomical features of hydrophytes, xerophytes, halophytes and parasites in relation to their habitats.

Suggested Readings

- Ecology:
Code: BSCBOT0614

Plant Physiology

Credits = 3

Course duration: 40 Hours

UNIT-I

Subunit-A (Plant Water Relations): Overview of plant cell structure and its chemical constituents; importance of water to plant life; Water as Biological solvent, physical and chemical properties of water; Solutions and Colloids; Diffusion and osmosis; Water potential and DPD; Absorption and transport of water; Transpiration and physiology of stomata.

____ 06 Hours

Subunit-B (Mineral Nutrition): Criteria of essentiality of minerals; Macro and micro elements and their role; Mechanism of mineral uptake; Deficiency and toxicity symptoms.

____ 03 Hours

Subunit-C (Photosynthesis): Significance; Historical aspects; Photosynthetic pigments; Photosynthetically active radiations; Absorption and action spectra; Red drop and enhancement effect; Concept of two photosystems; Z-Scheme of photosynthetic electron transport chain; Theories of photophosphorylation; Types of photophosphorylation; C-3, C-4 pathway of Carbondioxide fixation; CAM plants; Photorespiration; Law of limiting factors.

____ 10 Hours

UNIT-II

Subunit-D (Transport of Organic Solutes): Mechanism of phloem transport; Source sink relationship; Factors affecting translocation.

____ 03 Hours

Subunit-E (Plant Growth): Definitions; Phases of growth and development; Kinetics of growth; Measurement of growth.

____ 02 Hours

Subunit-F (Plant Growth Hormones): History, discovery, physiological role and mechanism of action of Plant growth hormones: Auxins, Gibberellins, Cytokinins, Abscisicacid and Ethylene; Physiology of senescence.

____ 07 Hours

Subunit-G (Photomorphogenesis): Definition; Discovery of Phytochromes, physiological role and mechanism of action; Cryptochromes and their role in development; Concept of Photoperiodism; Physiology of flowering and Florigen concept; Biological clocks; General account of Signal transduction.

____ 04 Hours

Subunit-H (Seed Germination and Dormancy): Definitions; Physiology of seed germination; Type of seed dormancy; Factors affecting seed dormancy; Methods of breaking seed dormancy; Significance of seed dormancy; Concept of vernalization.

____ 02 Hours

Subunit-I (Plant Movements): Overview of plant movements; detailed account of Phototropism, Gravitropism and Nastic movements.

____ 03 Hours
1. Methods of expressing the strength of a solution (Percent solution, Molar solution, Molal solution and ppm solution).
2. Demonstration of Tyndall phenomenon.
3. Preparation of suspension, emulsion, suspensoid and emulsoid.
5. Observation of streaming movement of the protoplasm.
6. Demonstration of Imbibition and Imbibition pressure.
10. Demonstration of water movement through xylem.
11. Demonstration of root pressure and guttation.
12. Stomatal studies: Calculation of stomatal index; Effect of light and dark; Effect of Potassium ions and ABA.
13. Demonstration of transpiration, its water lifting power and loss of weight during transpiration.
14. Study of relative rates of transpiration from the upper and lower surfaces of the leaf; A comparative study (Four leaf method; Cobalt chloride method and bell-jar method).
16. Preparation of nutrient solution for water culture experiments (Study of mineral deficiency).
17. Test of Phosphate, Nitrate, Potassium, Calcium and Iron in plant tissues.
20. Light reaction of Photosynthesis: Effect of different wavelengths; Ganong's light screen; Chlorophyll essentiality; Oxygen evolution and its measurement (Wilmott bubbler & Ganong's photosynthometer); Hill reaction demonstration.
21. Dark reaction of Photosynthesis: Carbon dioxide essentiality; Starch synthesis in chloroplasts.
22. Test the presence of Carbohydrates, Amino acids, Proteins, Lipids and Nucleic acids in plant tissues.
24. Translocation of Carbohydrates: Translocation out of leaves; Phloem as translocation channel.
25. Respiration: Demonstration of anaerobic and aerobic respiration; Fermentation (Kuhne's fermentation vessel); Release of carbon dioxide and use of oxygen during aerobic respiration.
27. Growth: Axial stem growth measurement by Arc-auxanometer and Pfeffer's (Automatic) auxanometer; Rooting effect of Auxins (IBA); Effect of Gibberllins (GA) on plant growth; Delaying of senescence by Cytokinins and fastening by Abscisic acid (ABA); Demonstration of etiolation in germinating seeds; Determination of seed viability by NTC test; Plant movements study (Phototropism, Geotropism, Hydrotropism and Seismonasty).
Suggested Readings

- Plant Physiology:
  
  
  
  
  
  
  

CORE ELECTIVE

Theory = 3 Credits  Practical = 1 Credit

In Core Electives, the teacher will conduct practicals based on theory course

Code: BSCBOT0408

Evolutionary Biology

Credits = 3

Course duration- 40 Hours

UNIT-I

Subunit-A (Origin of Life on Earth): Primitive earth; Major events in the history of life; Modern (Chemosynthetic) theory of life origin; Miller’s experiment; Geological Time Table (Up to Epoch level with characteristic life form). Phylogenetic tree of life as defined by comparative rRNA gene sequencing. ______05 Hours

Subunit-B (Palaeontology): Definition of fossils, Sub fossils, Pseudo fossils, Living fossils and Index fossils; Rocks and their types (Igneous, Sedimentary and Metamorphic rocks); fossilization process; Kinds of fossils and mode of their preservation; Techniques of study and reconstruction of fossils; Age determination of fossils by Radiocarbon dating technique. ______15 Hours

UNIT-II

Subunit-C (Organic Evolution): Meaning and evidences (Anatomical, Embryological, Physiological and Paleontological). ______03 Hours

Subunit-D (Evolutionary and Population Genetics): Lamark’s theory of inheritance of acquired characters; Darwin’s theory of natural selection; Hardy-Weinberg principle and its applications; Macro, Micro and Molecular evolution; Molecular clocks; Agents of evolutionary change (Mutation, Gene flow, Non-random mating, Genetic drift and Selection); Co-evolution; Cataclysmic evolution; Enzyme polymorphism; Species concept (Biological, Evolutionary and Ecological); Isolating mechanisms and type of speciation; Modern interpretation of Darwinism. ______17 Hours
PRACTICAL

Code: BSCBOT 0408(P)

Evolutionary Biology

Credit = 1

1. Study of Homologous, Analogous and vestigial organs in plants.
2. Study of atavism with reference to plants.
3. Study of Evolutionary Biology with the help of models and images.

Suggested Readings

• Evolutionary Biology:
UNIT-I

Subunit-A (Major classes of Biological Molecules): Proteins; Nucleic acids; Polysaccharides and Lipids; some common methods used to study macromolecules (Ultracentrifugation, Electrophoresis, Chromatography and Electron microscopy).

_____ 05 Hours

Subunit-B (Brief account of common experimental organisms used in Molecular Biology): Viruses; Bacteria; Mus musculus (Mice); Drosophila melanogaster (Fruit fly); Caenorhabditis elegans (Roundworm); Danio rerio (Zebra fish); Saccharomyces Cerevisiae (Yeast); Neurospora and Arabidopsis thaliana.

_____ 01 Hours

Subunit-C (Basic Molecular Genetic Mechanisms): DNA as the genetic material; DNA structure; Forms of DNA (A, B, C, D, E, Pand Z); DNA replication; DNA Protein interaction and Nucleosome model; Satellite and repetitive DNA; Modern concept of gene; RNA structure (m-RNA and t-RNA); Ribosome structure; Flow of genetic information; Genetic code; Mechanism of protein synthesis; Regulation of gene expression in prokaryotes and eukaryotes.

_____ 08 Hours

UNIT-II

Subunit-D (Recombinant DNA Technology): Gene cloning using vectors (Plasmids, cosmids, viruses, transposons, YAC, BAC and PAC); Binary and shuttle vectors; Restriction enzymes used in cloning; Complementary DNA; Polymerase chain reaction and gene amplification; DNA library; Colony hybridization; Blotting techniques (Southern blotting, Northern blotting and Western blotting); DNA sequencing (Maxam and Gilbert method; Sanger's method) and site directed mutagenesis; DNA fingerprinting; DNA footprinting.

_____ 15 Hours

Subunit-E (Genomics and Proteomics): Definition; Type of genomics (Structural, functional and comparative); Introduction to genome sequencing and its significance; Human genome project; Outline of gene sequencing methods (Direct sequencing of Bacterial artificial chromosome, Random shotgun sequencing, Whole genome shotgun sequencing, Expressed sequence tag approach); Definition and objectives of proteomics; Relationship between gene and protein; Types of proteomics.

_____ 08 Hours

Subunit-F (Bioinformatics): Definition; Historical background; Database; Classification of database; Brief outline of sequences and nomenclature; Information sources (NCBI, GBD and MGD); Use of Bioinformatics tools in analysis.

_____ 03 Hours
PRACTICAL

Code: BSCBOT 0512(P)

Molecular Biology

Credit = 1

1. Demonstration of Equipments: Spectrophotometer; Centrifuge; Electrophoresis unit; pH meter; Water bath; Incubator; Hot air oven; Shaker; Magnetic stirrer; Test tube shaker; Heating plate; Distillation plant; Autoclave; Laminar air flow; PCR; Analytical digital balance; Single-pan balance; Good quality microscope with projection system.

2. Isolation of Genomic DNA.

3. DNA detection by Gel electrophoresis.

*Subject to the availability of lab facilities. Teacher may demonstrate with the help of images.

Suggested Readings

• Molecular Biology:

Code: BSCBOT 0615

Plant Pathology

Credits = 4

Course duration- 40 Hours

• Introduction: Definitions and terms used in plant pathology; Classification of plant diseases on the basis disease spread and major causal agent; Indian contribution to plant pathology. 02 hours

• Disease Inciting Agents: Fungi; Bacteria; Mycoplasma; Algae; Phanerogamic parasites; Nematodes; Viral; Deficiency and toxicity of minerals; Pathogenesis. 02 hours

• Symptoms of Plant Diseases: Symptoms caused by Fungi, Bacteria, Plant viruses, Mycoplasma and Nematodes. 05 hours

• Dissemination of Plant Pathogens and Virus Transmission: Dissemination by air, water, animals and man; Transmission of plant viruses. 02 hours

• Plant Disease Forecasting: Methods used in forecasting. 01 hours

• Host parasite Inter-relationship and Interaction: Mechanism of infection; Enzymes, growth regulators and toxins in plant disease. 04 hours

• Effect of Climatic Conditions on Plant Diseases: General account; Predisposing factors. 01 hour

• Defence Mechanism: General account; Structural and biochemical defence; Biochemical defence induced by the attacking pathogen; Inactivation of pathogen enzyme; Detoxification of pathogen toxins. 05 hours

• Principles of Plant Disease Control: Cultural methods; Chemical methods; Breeding for disease resistance. 05 hours
• Specific diseases: White rust of crucifers; Late blight of potato; Apple scab; Loose smut of wheat; Rust of wheat; Early blight of potato; Tikka disease of groundnut; Red rot of sugarcane and Citrus canker. 13 hours

Code: BSCBOT 0616

Microbiology

Credits = 4

Course duration- 40 Hours

• Introduction to Microbiology: Origin of microorganisms; Organisms of microbial world; Differences between prokaryotic and eukaryotic cells; Contribution of Antony van Leeuwenhoek, Louis Pasteur and Robert Koch; Scope of microbiology; Microbial evolution; Classification of microorganisms. ________04 hours

• Microbiological Methods: Sterilization methods; Media preparation; Isolation methods; Maintenance and preservation of cultures; Light and Electron microscopy; Gram's staining of bacteria. ________04 hours

• Structure and Function of Bacterial Cells: Size, shape and ultrastructure of bacterial cell; Bacterial nutrition; Bacterial photosynthesis; Endospore structure; Locomotion in bacteria. ________05 hours

• General account of Viruses, Viroids and Prions. ________03 hours

• Basic Molecular Genetic Mechanisms and Microbial Genetics: DNA as the genetic material; DNA structure; RNA structure (m-RNA and t-RNA); Ribosome structure; Flow of genetic information; Genetic code; Mechanism of protein synthesis; Gene mutations at molecular level; Regulation of gene expression in prokaryotes; Bacterial genetic recombination (Transformation, Conjugation and Transduction). ________09 hours

• Recombinant DNA Technology: Gene cloning using vectors (Plasmids, cosmids, viruses, transposons); Binary and shuttle vectors; Restriction enzymes used in cloning; Complementary DNA; Polymerase chain reaction and gene amplification; DNA library; Colony hybridization; Blotting techniques (Southern blotting, Northern blotting and Western blotting). ________09 hours

• Economic Importance of Microbes: Role of microbes in Industry, Health, Agriculture and Environment_______03 hours

• Microbial Ecology: Microbial interactions; Extremophiles; General account of Soil, Air and Water microbiology. ________03 hours

Suggested Readings


Techniques in Biological Research

Credits = 4

Course duration - 40 Hours

- **Basic Principles**: Lab safety and hygiene; Units of measurements; Basic statistical concepts for biochemical analysis. 03 hours
- **pH and Buffers**: pH Scale; pH Meter; Buffers and their types. 03 hours
- **Cell Culture Techniques**: Introduction; Organisation of cell culture laboratory; Equipments; maintenance of aseptic environment; Media preparation for bacteria and stem cell culture. 04 hours
- **Microscopy Techniques**: Light microscopy, Electron microscopy and their types; Sample preparation for light and electron microscopy; Imaging of living cells and tissues. 06 hours
- **Centrifugation Techniques**: Basic principles; Preparative and Analytical centrifugation. 02 hours
- **Spectroscopy Techniques**: Basic principles; Ultraviolet and Visible spectroscopy; Brief account of Infrared and Raman spectroscopy; EPR, NMR and XRD. 07 hours
- **Chromatographic Techniques**: Principles of Chromatography; Gas chromatography; High-Performance liquid chromatography. 05 hours
- **Electrophoretic Techniques**: General principles; Capillary electrophoresis; Electrophoresis of proteins and nucleic acids. 04 hours
- **Immunological Techniques**: Fluorescent activated cell sorting (FACS). 03 hours
- **Mass spectrometric Techniques**: Introduction; Ionisation; Mass analysers and detectors. 03 hours

**Suggested Readings**

Utilization of Plants

Credits = 4

Course duration - 40 Hours

- **Introduction:** Origin of Cultivated plants; Importance of plant and plant products to mankind.
  
- **Fibres and Fibre Plants:** Classification of fibres; Cotton; Flax; Hemp; Jute; Ramie; Sisal; Coconut and Kapok.
  
- **Cereal Crops:** Wheat; Rice; Maize; Barley; Oats and Rye.
  
- **Sugars, Starches and Cellulose Products:** Sources of sugars; Sugarcane and sugar beet; Starches and starch products; Cellulose products; Paper and paper making.

- **Legumes:** Legumes; Forage crops; Tree legumes.

- **Fatty oils and Waxes:** Sources of fatty oils; Waxes and Soap substitutes.

- **Fruits:** Classification of fruits; Common fruits of Indian subcontinent; Fruits of temperate and tropical regions; Important fruit plants of Himachal Pradesh; Preservation of fruits.

- **Vegetables:** Common vegetables of Indian subcontinent; Earth vegetables; Herbage vegetables and Fruit vegetables.

- **Spices, Condiments and other Flavouring materials:** Common Spices, Condiments and flavouring materials of Indian subcontinent; Spices obtained from bark, flower and flower buds, fruits, seeds and leaves; Other spices and flavouring materials.

- **Beverages:** Tea; Coffee and Cocoa.

- **Forest Products:** Importance, structure and mechanical properties of wood; Factors influencing the mechanical properties of wood; Uses of wood; Indian forests; Important timber plants of India and their identification; Timber wealth of Himachal Pradesh.

- **Rubber and Other Latex Products:** Para rubber; Substitutes for Para rubber; Synthetic rubber.

- **Medicinal Plants:** History of medicinal plants; Drug plants; Classification of drugs; psychoactive drugs.

**Suggested Readings**

Ethnobotany

Credits = 4

Course duration- 40Hours

- Scope and aim of ethnobotany in developing world; Father of Indian ethnobotany. . 01hours
- Ethnoecology / Traditional resource management. __ 02hours
- Agriculture: origins, traditional, industrialized, sustainable. 03hours
- Crop domestication, evolution, and conservation of genetic diversity. 04hours
- Interactions of humans and plants in the past: archaeobotany, paleoethnobotany, ethnohistory. ____________ 04hours.
- Indigenous knowledge, linguistic ethnobotany, and ethnobiological classification.. 04hours
- Quantitative ethnobotany and survey field methods. 04hours
- Plants in symbolism, ritual, and religion.. __ 01hours
- Plants in material culture / fibers, plant structure related to uses. __ 02hours
- Plants in nutrition and dietary patterns / Fermented foods. __ 02hours
- Systems of traditional medicine in India; Medicinal floral wealth of Himachal Pradesh. 04hours
- Phytochemistry / Human uses of plant secondary metabolites / Foods as medicines; Psychoactive plants. 03 hours
- Global movement of plants and human cultures. __ 02hours
- Non-timber forest products / plants and markets. __ 02hours
- Plants and Indigenous cultures of India with special reference to Himachal Pradesh.. 02hours

Suggested Readings

- Ethnobotany:
Code: BSCBOT 0620

Plant breeding
Credits = 4

Course duration - 40 Hours

• Nature and Scope of Plant Breeding: History of plant breeding; Definitions; Aims and objectives. 04 hours
• Mode of Reproduction in Relation to Plant Breeding: Importance; Methods of reproduction; Mode of reproduction. 04 hours
• Methods of Crop Improvement: Selection; Hybridization; Introduction and acclimatization. 04 hours
• Mass Selection: Definition; Procedure; Applications and uses; Advantages and limitations. 04 hours
• Pure line and Pure line Selection: Definitions; Characters; Field technique; Uses; Advantages and disadvantages. 04 hours
• Clone and Clonal Selection: Definitions; Characters; Importance; Field technique; Uses; Advantages and disadvantages. 02 hours
• Hybridization: Definition and types; Applications and objectives; Prerequisites; Advantages and disadvantages. 05 hours
• Heterosis and Hybrid Vigour. 05 hours
• Plant Introduction and Acclimatization. 03 hours
• Mutation Breeding and Breeding for Disease Resistance. 05 hours

Suggested Readings
• Plant Breeding:

Code: BSCBOT 0621

Biodiversity

Credits = 4

Course duration - 40 Hours

• Biodiversity Science: Introduction; Biodiversity concept and definition; Biodiversity hot spots; Scope of biodiversity. 03 hours
• Genetic Diversity: Nature and origin of genetic variations; Determination of genetic diversity. 02 hours
• Species Diversity: Species inventory; Species diversity. 03 hours
• Agrobiodiversity and Cultivated Taxa: Origin and evolution of cultivated species diversity; Diversity in domesticated species; Wild plants; Feral plants; Domesticated microbes. 05 hours
• Ecosystem Diversity: Classification of ecosystems; Measurement of ecosystem diversity; Major ecosystem types of the world. 05 hours
• Values and Uses of Biodiversity: Biodiversity values; Ethical and aesthetic values; Precautionary principle; Methods of biodiversity valuation; Uses of plants. 05 hours
• Loss of Biodiversity: Loss of genetic diversity; Loss of species diversity; Loss of ecosystem diversity; Loss of agrobiodiversity. 05 hours
• Biodiversity Conservation: Need of biodiversity conservation; Conservation of genetic, species, and ecosystem diversity; In-situ and ex-situ conservation; Management of plant biodiversity; Role of women. 09 hours
• Role of Biotechnology: Biotechnology in utilization of biodiversity; Adverse impacts of biotechnology on biodiversity. 03 hours
Suggested Readings

• Biodiversity:

Code: BSCBOT 0622

Bioinformatics

Credits = 4

Course duration- 40Hours

• Introduction to Bioinformatics: Definition; Importance and scope. ________ 02hours
• Genetic Engineering Methods: Introduction to genetic engineering; Vectors and Restriction enzymes; Technique of making Recombinant DNA. ________________ 05hours

• Database: Introduction to database; Sequence databases; Structure databases; Genome mapping databases; Biological culture and stock collection databases; Enzyme and metabolic pathways databases; Information retrieval from biological databases; Information sources. 05hours
• Sequence Alignment and Database Searching: Introduction to sequence alignment; Pairwise alignment; Significance of sequence alignment and types; Evolutionary basis of sequences alignment. 05hours
• Phylogenetic Methods: Phylogenetic models; Phylogenetic data analysis; Tree building methods; Phylogenetic software. ____________05hours
• Predictive methods: Predictive methods using nucleotide and protein sequences. 04hours
• Genomics and Proteomics: Definition; Type of genomics (Structural, functional and comparative); Introduction to genome sequencing and its significance; Human genome project; Outline of gene sequencing methods (Direct sequencing of Bacterial artificial chromosome, Random shotgun sequencing, Whole genome shotgun sequencing, Expressed sequence tag approach); Definition and objectives of proteomics; Relationship between gene and protein; Types of proteomics. _______________ 12hours
• Bioinformatics Software and its Applications. _______02hours

Suggested Readings

OPEN ELECTIVE COURSES

Theory = 3 Credits Practicals = 1 Credit

In Open Electives, the teacher will conduct practicals based on theory course

Code: BSCBOT 0623

Floriculture

Credits = 4

Course duration-40 Hours

• **Introduction:** History of gardening; Importance and scope of floriculture and landscape gardening. 02 hours

• **Nursery Management and Routine Garden Operations:** Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators. 08 hours

• **Ornamental Plants:** Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai. 09 hours

• **Principles of Garden Designs:** English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. 05 hours

• **Landscaping Places of Public Importance:** Landscaping highways and Educational institutions. 05 hours

• **Commercial Floriculture:** Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Lilium, Orchids). 07 hours

• **Diseases and Pests of Ornamental Plants.** 04 hours

Suggested Readings

• **Floriculture:**

Mushroom Cultivation
Credits = 4

Course duration- 40 Hours

**Introduction:** History and introduction; Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. ______ 05 hours

**Classification:** Systematic position, morphology, distribution, structure and life cycle of *Agaricus*; Types of mushroom. ______ 03 hours

**Cultivation:** Equipments for mushroom spawn, Laboratory, culture room, spawn production mushroom farm layout and mushroom shed; Paddy straw mushroom - substrate, spawn making; Methods - bed method, polythene bag method, field cultivation. Oyster mushroom cultivation - substrate, spawning, pre-treatment of substrate. Maintenance of mushroom. Cultivation of white button mushroom - spawn, composting, spawning, harvesting. ______ 20 hours

**Disease Management:** Diseases - Common pests, disease prevention and control measures. ______ 05 hours

**Processing:** Blanching, steeping, sun drying, canning, pickling, freeze drying. 05 hours.

**Storage:** short term and long term storage. ______ 02 hours

**Suggested Readings**

- **Mushroom Cultivation:**
GENERAL INTEREST COURSES

Code: BSCBOT 25

Psychoactive Plants and Society

Credits = 1

Course duration- 40 Hours

- **Introduction:** Historical aspects; Definition of psychoactive plants; Distribution of psychoactive principle in plant groups. ________________ 04 hours
- **Some Examples of Psychoactive Plants:** Atropa belladonna, Cannabis sativa, Datura metel, Erythroxylococa, Lophophora williamsii, Mandragora officinarum, Nicotiana tabacum, Ipomea violacea, Papaver somniferum, Amanita muscaria, Psilocybe mexicana; Psychoactive plants with reference to Himachal Pradesh. ________________ 14 hours
- **Type of Psychoactive Drugs:** Stimulants, Hallucinogens and Depressants; Medicinal use; Designer drugs. ________________ 06 hours
- **Chemical Nature of Psychoactive Drugs:** Alkaloids and THC. ________________ 06 hours
- **Drug Abuse:** Development of drug abuse and drug addiction; Methods of taking drugs (Powders and Snuffs, Smoking, External application); Deterioration of health; De-addiction; Illegal trade names of Opium; Drug trafficking. ________________ 06 hours
- **Legislation:** Highlights of NDPS Act-1985. ________________ 04 hours

**Suggested Readings**

- Psychoactive Plants and Society:

Code: BSCBOT 26

Credits = 1

Digital Photography

Course duration- 40Hours

• Introduction: Digital camera features; Advantages of digital photography; Point and shoot camera; DSLR camera; Digital video camera; Image sensor; Image processor. 05hours
• Basic Camera Operation: Camera settings (Quality settings, white balance, ISO); Aperture and shutter speed; Built in flash and external flash. 05hours
• Some Useful Accessories: Camera bags, flash units, Tripods, monopods and other stabilizers; Battery and memory cards. 03hours
• Lenses: Basics of lens; Understanding the lens optics; Standard, zoom, wide-angle, telephoto and speciality lenses; Lens filters. 03hours
• Digital Photography Techniques: Metering mode selection; choosing the proper exposure; Creative techniques. 05 hours
• Image Editing: File formats (TIF, JPEG and RAW); Advantages and disadvantages of RAW format; Basic colour correction; Adjusting exposure and sharpening of images;Cropping. 06hours
• Tackling Photographing Subjects: Photographing people, sports, nature and landscapes. 06hours
• Digital Photography for Research and Documentation. 04hours
• Techniques for Unusual Images: Moving water and firework display. 03hours.

Suggested Readings

Annexure-I

Batch : 2015-onwards

HIMACHAL PRADESH UNIVERSITY SHIMLA-171005

CHOICE BASED CREDIT SYSTEM
(CBCS)-B.Sc. Botany (Major)

Syllabus and Examination for B.Sc. Botany (Major)

Under CBCS

Semester System

June 2016 (IIIrd semester- onwards)
BIOSCIENCES DEPARTMENT
HIMACHAL PRADESH UNIVERSITY

OUT LINES OF SYLLABI AND COURSES OF READING
IN THE SUBJECT OF BOTANY FOR B. Sc. WITH MAJOR IN BOTANY AND
MINORELECTIVE IN BOTANY (2016-2017 onwards)

(A) Structure Outline of Major in Botany (Minimum Credits to be Earned=56)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Type</th>
<th>Course Name</th>
<th>Credit(s)/ week</th>
<th>Cumulated Credits Categorywise</th>
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**Core – 12 (36)**
**Elective – 8 ((32)**
**Core / Elective (additional) - 4**
**Total 24 (93)**
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**Note:** Students in VI semester can opt any of the following courses.

*Additional Elective Courses offered by Biosciences Department in Botany (can be chosen for earning credits over and above 56 Major subject credits, 40 Minor elective credits, 9 (Min.) Compulsory course credits and 1 (Min.) 3GI & H Course credits i.e. total 106 credits; for getting B.Sc. Degree a learner has to earn a minimum of 120 credits.) Students in VI semester can opt any of the following courses.
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*Open Elective Courses offered by Botany Department

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Structure Outline of Minor Elective in Botany for other than Major Botany Students (Minimum Credits to be Earned=20). Other than Botany Major Learner can do Double major by earning 34 more credits over and above 20 credits of Minor Elective.

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Annexure-I

Batch : 2015-onwards

HIMACHAL PRADESH UNIVERSITY SHIMLA-171005

CHOICE BASED CREDIT SYSTEM
(CBCS)-B.Sc. Botany (Major)

Syllabus and Examination for B.Sc. Botany (Major)

Under CBCS

Semester System

June 2016 (IIIrd semester- onwards)
# Course List

**HIMACHAL PRADESH UNIVERSITY, SHIMLA-171005 CHOICE BASED CREDIT SYSTEM (CBCS) IN BOTANY CBCS Programme for B.Sc. with BOTANY (Major)**

**June 2016**

<table>
<thead>
<tr>
<th>Code</th>
<th>Core Course (Hard Core)</th>
<th>Teaching Hrs.</th>
<th>Credits</th>
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<tr>
<td><strong>SEMESTER I</strong></td>
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<tr>
<td>BSCBOT0101</td>
<td>Phycology,Mycology and Plant Pathology</td>
<td>40</td>
<td>3+1=4</td>
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<tr>
<td>BSCBOT0102</td>
<td>Bryophyta and Pteridophyta</td>
<td>40</td>
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<tr>
<td><strong>SEMESTER II</strong></td>
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<tr>
<td>BSCBOT0203</td>
<td>Palaeobotany and Gymnosperms</td>
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<tr>
<td>BSCBOT0204</td>
<td>Plant Taxonomy and Selected Families of Angiosperms</td>
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<td><strong>SEMESTER III</strong></td>
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<tr>
<td>BSCBOT0305</td>
<td>Economic Botany and Plant Anatomy</td>
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<tr>
<td>BSCBOT0306</td>
<td>Embryology of Angiosperms</td>
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<td><strong>SEMESTER IV</strong></td>
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<td>BSCBOT0407</td>
<td>Cytogenetics</td>
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<td>BSCBOT0409</td>
<td>Cell Biology</td>
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<td>BSCBOT0613</td>
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<td>BSCBOT0614</td>
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<td>Plant Breeding</td>
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<td>BSCBOT0621(also Open in IV semester)</td>
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Scheme of Examinations for every major /minor and additional course:

End semester examination = 40 marks  Time 3 hrs

Internal Assessment = 30 Marks (Unit Test= 15 Marks, Assignment=10 Marks & Attendance= 5 Marks)

Practicals of every major/minor/additional course = 30 Marks  Time 3 hrs

General Interest and Hobby Courses = 50 marks

CCA  15 Marks (Assignment =10 Marks & Attendance=5 Marks)

ESE  35 Marks