

**Ch. Charan Singh University, Meerut Campus**  
**M.Sc. Botany (Choice Based Credit System) Syllabus**  
 Effective from session 2016-17

**Distribution of marks in different courses**

<b>I Semester</b>	<b>Course Title</b>	<b>Credits</b>	<b>Total Marks (Int.+Ext.)</b>
Core Compulsory Theory I/	Phytotechniques and Biostatistics	4	40+40
BOTC.C.T II/	Microbiology	4	40+40
BOTC.C.T III/	Algae and Bryophytes	4	40+40
BOTC.C.T IV/	Taxonomy of Angiosperm and Economic Botany	4	40+40
BOTC.C.Practical - I (4 Hours)	Based on Courses I-IV	2+2+2+2	80
BOTOET I (Open Elective TheoryI):	Self- Study-1A. Hindi/B. English/C. Urdu/D. Sanskrit	4	100
	<b>Total Credits/marks</b>	<b>28</b>	<b>500</b>

<b>II Semester</b>	<b>Course Title</b>	<b>Credits</b>	<b>Total Marks</b>
BOTC.C.T V/	Mycology and Plant Pathology	4	40+40
BOTC.C.T VI/	Pteridophytes, Gymnosperms and Palaeobotany	4	40+40
BOTC.C.T VII/	Molecular Biology and Biotechnology	4	40+40
BOTC.C.T VIII/	Cell Biology & Genetics	4	40+40
BOTC.C.P II (4 Hours)	Based on Courses V-VIII	2+2+2+2	80
BOT OET (Open Elective Theory) II	Disaster Management	4	100
	<b>Total Credits/marks</b>	<b>28</b>	<b>500</b>

<b>III Semester</b>	<b>Course Title</b>	<b>Credits</b>	<b>Total Marks</b>
BOTC.C.T IX/	Plant Water relations; Growth and Development	4	40+40
BOTC.C.T X/	Phytochemistry and Metabolism	4	40+40
BOTC.C.T XI/	Anatomy and Reproduction in Angiosperms	4	40+40
BOTC.C.T XII/	Plant Ecology and Phytogeography	4	40+40
BOTC.C P III (4 Hours)	Based on theory courses IX-XII	2+2+2+2	80
BOTOET III (Open Elective Theory III):	Environmental Awareness	4	100
	<b>Total Credits/marks</b>	<b>28</b>	<b>500</b>

<b>Specializations</b>	<b>IV Semester</b>	<b>Course Title (Core Elective Courses (Set of two courses each for specialization) CET I+ IV/V, CET II +III, CET-VI+VII</b>	<b>Credits</b>	<b>Total Marks</b>
BOTC.E.T-I Plant Biotechnology	Course XIII /	A. Recombinant DNA technology	4	40+40
	Course XIV /	A. Plant Tissue Culture	4	40+40
BOTC.ET. II. Microbial and Environmental Biotechnology	.Course XV /	B. Microbial Biotechnology	4	40+40
	Course XVI /	B. Environmental Biotechnology	4	40+40
BOTC.E T.III. Applied and Stress Physiology	Course XIII /	C. Stress Physiology of Plants	4	40+40
	Course XIV /	C. Applied Plant Physiology	4	40+40
BOTC.E.T.IV Medicinal Botany	Course XV /	D. Pharmacognosy	4	40+40
	Course XVI /	D. Post -Harvest technology of medicinal plants	4	40+40
BOTC.E.T V Biodiversity and Conservation	Course XV/	E. Diversity in Plants, their origin and evolution	4	40+40
	.Course XVI	E. Biodiversity conservation and Plant Resources	4	40+40
BOTC.E.T VI. Applied Plant Pathology	Course XV/	F. Applied Mycology	4	40+40
	Course XVI/	F. Molecular Plant Pathology	4	40+40
BOTC.E. T7 Computer Science & Bioinformatics	Course XIII/	G. Elementary Computer knowledge	4	40+40
	Course XIV/	G Genomics & Bioinformatics	4	40+40
BOTC.C.P. IV (4 hours)	Practical based on two sets of Core Electives	Based on theory courses XIII-XIV and two out of XV-XVI	2+2+2+2	80
BOTOET IV (Open Elective Theory IV):	Self-Study 4	Team work on Intellectual Property Rights/ Projects/ Assignments provided by	4	100

		other departments		
		Total Credits/marks	28	500
		Grand Total Credits/marks	112	2000

A candidate can select any two sets of elective courses from XIII to XXVIII (as per availability in the institution) to serve as specialization (s). Each core (compulsory and elective) course will have 4 hours theory and 4 hours practical in each week, equaling 4+2=6 credits. In each semester there will be one open elective of 4 credits each. A minimum of 108 credits are required to be earned for successful completion of the Master's degree including a minimum of 72 credits of Core Compulsory, 24 credits of Core elective and 12 credits of open elective courses.

All regulations of CBCS courses as provided by the University ordinances and modified from time to time will become effective from the given dates.

A minimum of 30% marks separately in internal and external assessment of each course and an aggregate of 40% marks in all the courses (including practical) is required for passing. In case of failing to obtain 30% marks in internal assessment of any paper, the candidate will not be eligible to appear in external examination of that course.

Internal assessment will be based on :

Quizzes -2: (from first Unit) Each for 4 marks

Tests-2: for 8 marks each (based on 2 units each)

Seminar/ Term Paper: 8 marks in each paper

Eligibility for admission to the course: B.Sc (Bio)/B.Sc. (CBZ)/B.Sc. (Life Sc.)/Hons. with minimum 55% marks and Intermediate with second division (45%) or with 50% aggregate marks in B.Sc and Intermediate both. In the subject itself minimum 50% marks are necessary for eligibility.

**Unit I****10 Hours****Basic Botanical techniques:**

1. Different types of stains, their preparation and uses: Safranin, fast green, hematoxylin, iodine, cotton blue, crystal violet, ruthenium red, Janus green, Gram's stains, Acetocarmine
2. Microscopy: Principle, parts and functioning of electron microscopes including stereoscopic binocular, dark field illumination, confocal, phase contrast, fluorescence and polarizing microscopes, camera lucida, SEM, TEM. STEM.
3. Microtomy: dehydration, clearing and embedding of material, section cutting, dewaxing.
4. Collection and preparation of herbarium sheets; preservation and storage of plant materials

**Unit II****10 Hours****Biophysical methods**

5. Instrumentation, principle and Methods of fractionation- Cell sorting, Chromatography, Electrophoresis, Centrifugation, X- ray diffraction

**Unit III****10 Hours****Methods of quantitative analysis-**

6. Spectrophotometry, MS, NMR, ESR, ORD/CD spectrometers,
7. Radioisotopic methods: Geiger Muller & Liquid Scintillation Counters.
8. Immunological methods: immunodiffusion, immuno- electrophoresis, crossed immuno- electrophoresis, counter- RIA, ELISA , Immunoblotting

**Unit IV****10****Hours****Statistical methods**

9. Classification and presentation of data, graphical presentation: frequency polygon and curve, & cumulative frequency curve. Distribution
10. Measures of Central tendency: mean, mode, median and their properties.
11. Measures of dispersion: Mean deviation, standard deviation and coefficient of variation.

**Unit IV****10 Hours**

11. Simple correlation, coefficient and regression,
12. Principle of experimental designs, randomized block and Latin square designs and Analysis of Variance (ANOVA).
13. Tests of significance, t-tests, X<sup>2</sup> test for goodness of fit.

**BOTC.C.T.II**

**Microbiology**

**4 credits/50 Hours**

**Unit - I**

**10 Hours**

1. Development of microbiology as science, important contribution of pioneer microbiologists; golden era of microbiology.
2. Isolation, purification and cultivation of microbes from soil, water and air.
3. Important criteria used for classifications of microorganisms (morphological, ecological, biochemical, molecular and numerical).

**Unit - II**

**10 Hours**

**Bacteria:**

4. Classification of bacteria based on Bergey's manual of determinative bacteriology.
5. Archaeobacteria and Eubacteria: Characters, Ultrastructure, nutrition, genetic recombination (Transformation, Transduction, Conjugation), and economic importance.
6. Cyanobacteria: salient features, biological and economic importance.
7. **Phytoplasma**: General characteristics, structure, reproduction and role in causing plant diseases.

**Unit - III**

**10 Hours**

**Virus:**

8. Biological nature, characteristics and ultrastructure of Plant (TMV, Polaro, Papaya Mosaic Virus), animal (retro viruses and hepatitis B virus) and bacterial virus (T4 phi X174, M13), replication, transmission and economic importance of viruses.
9. Structure, reproduction and importance of viroids, virusoids, prions

**Unit - IV**

**10 Hours**

10. **Host-parasite interaction**: a brief idea of recognition and entry process of bacteria, viruses into animal & plant-host cells, alteration of host cell. Virus induced cancer; bacteria and plant two- component signaling systems; bacterial chemotaxis and quorum sensing. Hormones and their receptors, signaling through G-protein coupled receptors, regulation of signaling pathways.
11. **Innate and adaptive immune system**: Types of Immunity, antigens, antigenicity, structure and function of antibody molecules, monoclonal antibodies, Antigen-antibody interactions (serology), activation & differentiation of B and T Cell, B & T cells receptors, MHC molecules complement system, immune response during bacterial (tuberculosis), parasitic (malaria) and Viral (HIV) infections, vaccine.

**Unit - V**

**10 Hours**

12. Distribution of microbes in air, water, soil and human body.
13. Microbes for control of pollution.
14. Microbial enzymes and their applications.
15. Microbes in nanobiotechnology.

**Algae:**

1. Classification and salient features of different classes of Algae.
2. Algal cell biology.
3. Algal pigments, food reserves, flagellation and their importance in classification.
4. Major contributions of algologists in India.
5. Thallus organisation, reproduction and life cycle patterns.
6. Economic importance of algae as food, feed, source of chemicals and drugs, Bioenergy, Algal biofertilizers, industrial uses.
7. Algae as source of bioremediation, bioindicator (algal blooms),

**Unit - II****10 Hours**

8. Comparative study of classes of Chlorophyceae, Xanthophyceae and Bacillariophyceae, with help of diagram:
  - a. Range of thallus organization including ultrastructure.
  - b. Methods of reproduction.
  - c. Variation in life cycles.
  - d. With special reference to *Hydrodictyon*, *Pithophora*, *Ulva*, *Cosmariun*, *Bryopsis* and *Stigeocolium*.

**Unit - III****10 Hours**

10. Comparative study of Phaeophyceae and Rhodophyceae with reference to:
  - a. Range of thallus organization.
  - b. Method of reproduction.
  - c. Variation in life cycles.

**Unit - IV****10 Hours****Bryophytes:**

11. Classification of Bryophytes and their distribution in India.
12. Range of thallus structure (plant body) and anatomy in Bryophytes (with suitable examples)
13. A general account of Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Funariales and Polytrichales.
14. Major contribution of bryologist in India.

**Unit - V****10 Hours**

15. Evolutionary tendencies in sporophytes of Bryophytes (Progressive sterilization of sporogenous tissue)
16. Reproduction, life history, Inter-relationship, affinities of various groups of Bryophytes.
17. Ecology and economic importance of Bryophytes.

**BOTC.C.T.IV Taxonomy of Angiosperms and Economic Botany 4 credits/ 50 Hours**

**Unit- I**

**10 Hours**

**Taxonomy of Angiosperms:**

1. History of plant Taxonomy.
2. International Code of Botanical Nomenclature (ICBN). Salient feature, important rules and recommendation, Binomial nomenclature, botanical gardens and herbaria.
3. Taxonomic evidences: Morphology, Plant anatomy, Palynology, Embryology, Cytology, Phytochemistry, Genome analysis and DNA hybridization technique in relation to taxonomy, numerical taxonomy, serotaxonomy.

**Unit- II**

**10 Hours**

4. The species concept: Taxonomic hierarchy, species, genus, family and other categories, Principles used in assessing relationship, delimitation of taxa and attribution of rank. Variation and specialization in plants.
5. Phylogenetic systems of classification: Hutchinson, Cronquist, Takhtajan and Dahlgren. Outlines, merits and demerits.
6. Basic knowledge of phycocode and A P G system.

**Unit- III**

**10 Hours**

7. Range of floral structure and phylogeny in:

**I. Dicotyledons:**

- a. Magnoliidae with special reference to Magnoliaceae, Capparidaceae, Piperaceae,
- b. Hamamelidae with special reference to Moraceae, and Casuarinaceae,
- c. Caryophyllidae with special reference to Cactaceae, Chenopodiaceae and Polygonaceae,
- d. Dilleniidae with special reference to Tiliaceae, Sterculiaceae, Violaceae,
- e. Rosidae with special reference to Lythraceae, Combretaceae,
- f. Asteridae with special reference to Boraginaceae, Scrophulariaceae, Bignoniaceae

**Unit- IV**

**10 Hours**

**II. Monocotyledons:**

- a. Alismatidae,
- b. Commelinidae with special reference to Commelinaceae and Zingiberaceae,
- c. Arecidae with special reference to Araceae,
- d. Liliidae with special reference to Amaryllidaceae
- e. Orchidaceae

**Unit- V**

**10 Hours**

**Economic Botany:**

8. Botanical names, families, Plant part(s) used and uses of the economically important plants  
belonging to following categories:  
Fiber plants  
Spices and condiments  
Beverages  
Medicinal plants  
Non-wood plant products (NWPPs): rubber, dyes, resin, gums etc.

**Unit - I****10 Hours**

1. General characters of fungi, and range of thallus organization in fungi.
2. Types of reproduction in fungi.
3. Unique aspects of (i) fungal cells, (ii) molecular biology of fungi
4. Classification of fungi as proposed by Ainsworth (1973) Alexopoulos, Mims & Blackwell (1996), Hibbet *et al.* (2007). Recognition of Fungi as a separate kingdom; splitting of the fungi (Fungi and allied organisms into three kingdoms- Protista, Chromista and Fungi.
5. Nutrition and growth in Fungi including factors affecting fungal growth.
6. Differentiation in fungi: control of i) Dimorphism. ii) conidiation. iii) mating (with the help of Sex hormones).
7. Heterothallism, Heterokaryosis, parasexuality and physiological specialization in Fungi.

**Unit - II****10 Hours**

8. A general account and affinities of the following groups with special reference to systematic position, structure and reproduction of organisms mentioned hereunder:
  - I. The Fungi belonging to kingdom Protozoa:
    - a. Myxomycota (myxomycetes): *Stemonites, Ceratiomyxa,*
    - b. Plasmodiophoromycota (Plasmodiophorales) *Plasmodiophora.*
  - II. The Fungi belonging to Kingdom Chromista: *Saprolegnia, Phythium, Phytophthora, Albugo,*
  - III. The Kingdom Fungi:
    - a. Chytridiomycota: *Synchytrium,*
    - b. Blastocladiomycota: *Allomyces, Coelomomyces*
    - c. Zygomycota: *Saksanaea, Pilobolus, Entomophthora*
    - d. Ascomycota : *Taphrina, Phyllactinia, Erysiphae, Neurospora, Peziza*
    - e. Basidiomycota: *Puccinia, Uromyces, Hemilia, Melampsora, Tilletia, Ustilago*
    - f. Anamorphic fungi (Deuteromycotina): With reference to their telomorph, also wherever possible; *Cercospora, Helminthosporium, Curvularia, Alternaria, Fusarium, Colletotrichum, Aspergillus, Penicillium.*

**Unit - III****10 Hours**

9. Fungal interactions: I. Role of antibiotics, hyphal interference, II. Mycoparasitism, III. Commensalism, Mycorrhizae, Lichens (Structure, types, reproduction, importance),
10. Symptoms of fungal, bacterial and viral plant diseases.
11. Causes of plant diseases.
12. Host-parasite relationship, role of enzymes and toxins in disease development.
13. Effect of infection on physiology of host.
14. Effect of environment on disease development-epiphytotic, plant disease forecasting

**Unit - IV****10 Hours**

15. Disease control by Physical methods, chemical methods, crop rotation, plant quarantines, resistance
18. Integrated pest management mechanism, its advantages, disadvantages and



future prospects.

19. Principles of biological control of air- borne and soil-borne plant diseases. Fungi as biocontrol agents of air borne and soil borne plant diseases (antibiosis, hyphal interference and mycoparasitism)

**Unit - V**

**10 Hours**

20. Etiology and control of the following crop diseases:

Paddy : Paddy blast, Bacterial leaf blight.

Wheat : Black Stem rust, Bunt of wheat, Flag smut.

Jowar : Grain Smut.

Sugarcane : Smut, Red rot.

Cotton : Wilt

Grape : Downy and powdery mildew

Apple : Apple scab

Groundnut : Tikka disease.

Fibre : Rust of *Linum*

Coriander : Gall of coriander.

**BOTC.C.T. -VI: Pteridophytes, Gymnosperms and Palaeobotany 4 credits/50 Hours**

**Unit - I**

**10 Hours**

**Pteridophytes:**

1. Classification of Pteridophytes; specific characters of important classes.
2. Salient features, comparative organography, systematics, reproduction and Phylogeny of the following:
  - a. Psilopsida: Psilophytales (*Rhynia*, *Horneophyton*) and Psilotales (*Psilotum*, *Tmesipteris*).
  - b. Lycopsidea: Protolepidodendrales (*Protolepidodendron*), Lepidodendrales (*Lepidodendron*, *Stigmaria*), Lepidospermales (*Lepidocarpon*) and Isoetales (*Isoetes*).
  - c. Sphenopsida: Hyeniales (*Calamophyton*), Sphenophyllales (*Sphenophyllum*) and Calamitales (*Calamites*).
  - d. Pteropsida: Coenopteridales – A general account. Ophioglossales (*Ophioglossum*, *Botrychium*), Marattiales (*Marattia*, *Angiopteris*), Osmundales (*Osmunda*), Filicales (*Cyathea*, *Dryopteris*, *Pteridium*), Marsileales (*Marsilea*), Salviniiales (*Salvinia*, *Azolla*) and Indian Fossils.

**Unit - II**

**10 Hours**

3. Telome concept, Stellar system and evolutionary tendencies.
4. Heterospory and evolution of seed habit.
5. Apogamy, apospory, parthenogenesis.
6. Soral evolution in Pteridophytes; Alternation of generations.

**Unit - III**

**10 Hours**

**Gymnosperms:**

7. Classification and distribution of gymnosperms with special reference to India. Study of morphology, structure and life history as illustrated by the following: Pteridospermales: Palaeozoic and Mesozoic group with reference to Lyginopteridaceae (*Lyginopteris*), Medullosaceae (*Medullosa*), Glossopteridaceae and Caytoniaceae.
8. Bennettitales: Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.
9. Cycadales: A detailed account including distribution of *living* Cycads.
10. Pentoxylales: A general account.
11. Cordaitales: A general account of Cordaitaceae and Poroxylaceae.
12. Ginkgoales: *Ginkgo*.
13. Coniferales: *Abies*, *Cupressus*, *Podocarpus* and *Araucaria*.
14. Taxales: A general account.
15. Ephedrales, Welwitschiales and Gnetales: A general account.

**Unit - IV**

**10 Hours**

16. Evolutionary tendencies in Gymnosperms.
17. Economic importance of Gymnosperms.

**Unit - V**

**10 Hours**

**Paleobotany:**

20. Geological areas and distribution of plants in geological time scale.
21. Types of Fossils, Process of fossilization and fossil preservation methods.
22. Techniques of study of fossils; Distribution of fossils in India

**BOTC.C.T. -VII: Molecular Biology and Elementary Biotechnology 4 credits/50 Hours**

**Unit - I**

**10 Hours**

1. Nucleic Acids: Nature, Structure, Conformational analysis of DNA and RNA, (t-RNA, micro-RNA), DNA replication (Origin and fork) and its biosynthesis, transpositions and mechanisms of transposition
2. Protein Synthesis: mechanism of protein synthesis in prokaryotes and eukaryotes, transcription, RNA processing, translation and regulation of protein synthesis in prokaryotes (Structural, regulatory genes and operon model).

**Unit - II**

**10 Hours**

3. Definition, Basic concepts, Principles and scope of Biotechnology.
4. Recombinant DNA technology, basic concept in genetic engineering, tool and techniques of recombinant DNA technology.
5. Enzymology of genetic engineering: Restriction enzymes, DNA ligase, Polymerase etc.
6. Cloning vehicles: Plasmids, Cosmids, Lambda phage, Charon phage, shuttle vectors, 2 $\mu$  DNA plasmids, yeast plasmids, M13 vector.

**Unit - III**

**10 Hours**

7. Gene cloning: principles and techniques, choice of vectors, DNA synthesis and sequencing, Analysis and expression of cloned genes in host cells, RAPD, RFLP, AFLP
8. Gene libraries: mRNA isolation, cDNA synthesis, cloning and amplification of gene libraries, Genomic DNA libraries, techniques of gene mapping and chromosome walking.

**Unit - IV**

**10 Hours**

9. PCR: Principles, techniques and modification, Gene cloning vs PCR; Uses and applications of PCR.
10. Preparation of molecular probes and their uses. Labelling of probes, radioactive vs non-radioactive, techniques used in probing DNA, RNA and protein electrophoresis. Blotting techniques, DNA finger printing, gene therapy, genetic counselling.

**Unit - V**

**10 Hours**

11. Transgenic (Genetically modified) Plants: Genetic engineering of plants, Aims, strategies for development of transgenic plants (with suitable examples),
12. *Agrobacterium* - the natural genetic engineer, T-DNA and transposon mediated gene-tagging, chloroplast mediated transformation and its utility,

**Unit - I****10 Hours**

1. The Dynamic cell: Structural organization of plant cell, specialized plant cell.
2. Cell envelopes: Ultra-structure, chemical foundation and functions of cell wall, Biological membranes with special emphasis on plasma membrane and tonoplast membrane.
3. Plant Cell inclusions, their structure and function; Mitochondria, Chloroplast, Ribosome, Dictyosomes, Lysosomes, ER, Microbodies and Plasmodesmata.

**Unit - II****10 Hours**

4. Nucleus & Nucleolus: Structure, nuclear pores, nucleosome concept.
5. Chromatin Organisation: Chromosome structure and composition, Centromere, Telomere, Euchromatin and Heterochromatin, Karyotypes, Polytene, Lamp brush chromosomes and Sex chromosomes.
6. Structural aberrations of chromosomes Deficiency, duplication (meiotic pairing & phenotypic effects), Inversions, translocations, (meiotic pairing, Chromosome disjunction), multiple translocations.
7. Numerical changes in chromosomes and Haploidy
  - a) Euploidy/Polyploidy: Classification, production, role in evolution, utility in crop improvement.
  - b) Aneuploidy : Trisomics, tetrasomics, monosomy, multisomy- meiotic behaviours, breeding behaviour.

**Unit - III****10 Hours**

8. Mendel's Laws of inheritance and modified ratios.
9. Allelic and non- allelic interaction of genes.
10. Multiple alleles: alleles, coat colour in rodents, blood groups in Humans, self-incompatibility

**Unit - IV****10 Hours**

11. Linkage and crossing over: chromosome mapping, linkage groups, mechanism of chromosome pairing and synaptonemal complex.
12. Sex determination in plants.
13. Maternal effects and Extra- nuclear inheritance.
14. Cell cycle & Apoptosis: Biochemical and genetic mechanism and significance
  - a) Irregularities in Mitosis and
  - b) Programmed Cell Death (PCD).
  - c) Cytoskeleton with emphasis on spindle apparatus, motor movements.

**Unit- V****10 Hours**

15. Apomixis: Cytogenetic basis and types of Apomictic reproduction
16. Mutation: Types of mutations, spontaneous and induced mutations, Physical and chemical mutagens, gene mutations, induction and detection of mutation, mutation by transposons.
17. Concept of gene: gene structure and expression; gene fine structure, cis-trans test, Biochemical genetics, introns.
18. Genetic Code: Discovery, Properties and cracking of genetic code.

**BOTC.C.T. IX : Plant-Water Relations & Growth and Development 4credits/50 Hours**

**Unit - I**

**10 Hours**

**Soil - water-plant relations:**

1. Functional aspects of plant cell structure: colloidal systems, Water as a universal solvent, pressures and potentials.
2. Active and passive absorption of water. Factors affecting water absorption
3. Role of micro and macro mineral nutrients, their physiological functions and deficiency symptoms, Hydroponics.
4. Mechanism of ion (mineral) absorption. Factors affecting mineral absorption.

**Unit - II**

**10 Hours**

5. Driving forces and resistances in transpiration; stomatal movement mechanism.
6. Ascent of sap, Translocation of solutes in plants; sensor- regulator system, sucrose sensing mechanism.
7. Stress Physiology: Plant response to biotic and abiotic stress, mechanism of stress tolerance, HR and SAR, water deficit and drought resistance mechanism of salinity, metal toxicity, freezing heat and oxidative stress resistance,

**Unit - III**

**10 Hours**

**Growth & Development:**

8. Discovery, chemical structure, physiological role, mechanism of action, bioassay and practical applications of following plants hormones:
  - a. Auxins
  - b. Gibberellins
  - c. Cytokinins
9. Hormone receptors, cell signaling and Signal transduction

**Unit - IV**

**10 Hours**

10. Elementary idea of structure and functions of ABA, Ethylene, Ascorbic Acid, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.
11. Sensory photobiology: detection structure, chemistry, physiology, function and mechanism of action of phytochromes, cryptochromes and phototropins.
12. Photoperiodism; Photoinduction and vernalization, Role of florigen, vernalin, phytochrome and C/N ratio in flowering.

**Unit - V**

**10 Hours**

13. Dormancy: Dormancy of seeds and buds, gene expression during dormancy.
14. Seed germination and seedling growth, metabolism of nucleic acid, mobilization of reserved food material, hormonal control of seedling growth, gene expression during seedling growth.
15. Endogenous rhythms
16. Plant movements
17. Ageing and Senescence



**BOTC.C.T. XI : Anatomy and Reproduction in Angiosperms 4 credits/50 Hours**

**Unit-I**

**10 Hours**

**Plant Anatomy:**

1. Shoot development: organisation of shoot apical meristem (SAM), Cytological and molecular analysis, Leaf (Marginal meristem).
2. Root development: organisation of root apical meristem (RAM), Cell fates and lineage differentiation of vascular tissue, regulation of root growth.

**Unit - II**

**10 Hours**

3. Epidermal structures, ontogeny and classification of stomata, trichomes and secretory glands
4. Phloem: Structure and development of sieve elements, P-Proteins.
5. Xylem: Structure and development of tracheary elements.
6. Vascular cambium: normal and abnormal functioning.
7. Nodal Anatomy: evolution of nodal vasculature.

**Unit - III**

**10 Hours**

**Embryology:**

8. Formation of floral organs: floral development molecular basis of floral organ determination. Morphology of stamen, carpel and placentation, (MADS Box) Homeotic genes.
9. Megasporangium (ovule): Structure and development.
10. Female gametophyte: Megasporogenesis, organisation and types of embryo sac, gene function during megagametogenesis, ultra structure of embryo sac.
11. Anther: Structure, microsporogenesis, tapetum, pollen development, including pollen wall, pollen germination and pollen tube growth, development of male gametophyte, palynology and its applications.

**Unit - IV**

**10 Hours**

12. Pollen-Pistil interactions, Pollination mechanism and vectors, double fertilization.
13. Sexual Incompatibility: its genetic basis, molecular aspects, physiology and biochemistry. Barriers to fertilization, methods to overcome incompatibility.

**Unit - V**

**10 Hours**

14. Polyembryony: causes, classification and applications.
15. Endosperm: development, types, haustoria, mosaic endosperm, ruminant endosperm, xenia, metaxenia.
16. Embryogenesis: nutrition and growth of embryo; development of dicot and monocot embryos.
17. Fruit growth and development: with special reference to legumes and cucurbits.
18. Seed anatomy
19. Apomixis and Parthenocarpy: types and importance.

**Unit - I****10 Hours**

1. Ecological factors (light, air, water, topographic, edaphic, biotic)
2. Ecological concepts of species: Genecology and Ecological niche.
3. Population Ecology: Basic concepts, characteristics of population and population structure.
4. Community Ecology: Composition, characters, structure, origin and development of community: methods of study of structure of community.

**Unit - II****10 Hours**

5. Ecological succession: Process concept and trends. Climax. (Xerosere, hydrosere)
6. Ecosystem Ecology: Structure and functions, with example of a natural and artificial ecosystem, Energy flow in ecosystem.
7. Production Ecology: Measurement methods and productivity in different ecosystems.

**Unit - III****10 Hours**

8. Preliminary Knowledge of I.B.P. (International Biological Programme), M.A.B (Man and Biosphere Programme).
9. Pollution: Kinds of pollution (Air, Water, Soil and Noise) and green house gases, Ozone hole, and global warming.

**Unit - IV****10 Hours**

10. Recycling of waste: Biogas, utilization and disposal of organic wastes and inorganic wastes,
11. Biodiversity and It's conservation.
12. Biogeochemical cycles of C,N,P,S, and Hydrological cycle, Nutrient sources, Nutrient budgets in terrestrial communities and aquatic communities.
13. Soil erosion and conservation, rainwater harvesting, chipko movement, van mahotsava, Afforestation, reforestation.

**Unit - V****10 Hours****Phytogeography**

14. Principles of phytogeography, vegetation types and Phytogeographical regions of India. Age and area hypothesis, continental drift, endemism, Hot spots, Plant exploration. Invasion and introduction.
15. Remote sensing: Concepts, principles, processes, tools, techniques in acquisition of R.S. data. Application in ecological and meteorological research









**BOTC.E.T.-II MICROBIAL AND ENVIRONMENTAL BIOTECHNOLOGY**  
**Course XVI B: Environmental Biotechnology 4 credits/50 Hours**

**Unit - I 10 Hours**

1. Pollution and Pollutants: Cost of pollution, Kinds of Pollution and Pollutants- Air, Water, and Soil Pollution, Their effects on Plants and Ecosystems;
2. Role of Plants in Pollution Management.

**Unit - II 10 Hours**

3. Climate Change: Greenhouse Gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFCs: sources and roles), Ozone layer and Ozone hole, Consequences of Climate change (acid rain, global warming, sea level rise, UV radiation).

**Unit - III 10 Hours**

4. Ecosystem Stability: Concept (resistance and resilience), Ecological Perturbations (natural and anthropogenic) and Their Impacts on Plants and Ecosystems, Ecology of Plant Invasion, Environmental Impact Assessment (EIA), Ecosystem Restoration.
5. Environment and energy, Energy resources - Renewable and Non-renewable. Natural resources, Loss of Diversity, causes and consequences, Environmental Auditing, Conservation of Biodiversity.

**Unit - IV 10 Hours**

6. Ecological Management: Concepts, Sustainable Development, Remote sensing and GIS as Tools for Resources Management.

**Unit - V 10 Hours**

7. Phytoremediation: Prevention and Control, Methods of reducing Environmental impacts of Chemicals, Weedicides, Pesticides and Fertilizers. Biotechnological advances in pollution control through GEMs.

## BOTC.E.T.-III APPLIED AND STRESS PHYSIOLOGY

Course XIII C:

Stress Physiology of Plants

4 credits/50 Hours

### Unit-I

10 Hours

1. Biological stress vs. Physical Stress, Types of stresses and general methods of measurement of stress response (Strain),
2. Stress physiology in crop improvement
3. Response to UV stress: Injury and resistance mechanism

### Unit- II

10 Hours

4. Response to low temperature stress: Chilling, freezing, frost injury and mechanism of resistance, Adaptations
5. Response to high temperature stress: Injury and mechanism of resistance, Heat shock proteins, Adaptations

### Unit -III

10 Hours

6. Response to nutrient deficiency stress
7. Heavy metal stress, injury and mechanism of resistance, adaptations
8. Salinity stress, Ionic and salt stress injury, mechanism of resistance

### Unit-IV

10 Hours

9. Response to water deficit: Desiccation, Dehydration injury; Mechanism of resistance, Adaptations
10. Response to water excess: Flooding, hypoxia, Mechanism of resistance, Adaptations

### Unit-V

10 Hours

11. Causative agents for Biotic Stresses
12. Mechanism of Resistance against Fungal, Bacterial and viral pathogens



manufacture and uses of various nitrogenous, phosphatic, potassic and complex fertilizers and fertilizer mixtures, liquidfertilizers, biofertilizers, integrated plant nutrient systems.

2. Nutrient use efficiency (principles and approaches). Soil conditioners and amendments.

## BOTCET-IV : MEDICINAL BOTANY

**Course XVD: Pharmacognosy 4 hours /week/4 credits/50 Hours**  
**UNIT -I 10 Hours**

1. Introduction and Scope of Pharmacognosy: Pharmacognosy and modern medicine
2. Crude plant drugs
  - a) Sources: Geographical, Biological, Cell Culture and Sea
  - b) Classification: Morphological (Organized and unorganized), Taxonomical, Chemical, Pharmacological and alphabetical
3. Indigenous traditional drugs and their market adulteration of *Boerhaavia*, Shankhapuspi (*Clitoria*), Indian goose-berry, *Ocimum*, *Commiphora*, *Andrographis*.

**UNIT -II 10 Hours**

4. Types of Plant drugs and their Pharmacognostic study
  - a) Root drugs; *Glycyrrhiza* and *Ipecac*, *Rauwolfia*, *Shatavari* (*Asparagus*), *Coleus*, *Withania*
  - b) Rhizome drugs, Ginger (*Zingiber*)
  - c) Leaf drugs, *Andrographis*, *Clitoria*, *Senna*, *Artemisia*
  - d) Bark drugs: *Terminalia arjuna*, *Holorrhena*, *Taxus*
  - e) Flower drugs: Saffron (*Crocus*), Safflower (*Carthamus*), *Spilanthes*
  - f) Seed drugs: *Piper longum*, *Mucuna*
  - g) Fruit drugs: Cumin (*Carum cuminum*), Amla (*Emblica*), Senna pods (*Cassia senna*)
  - h) Whole plant drugs: *Catharanthus roseus*

**UNIT -III 10 Hours**

5. Evaluation of the drugs; Organoleptic, Microscopic, Physical, Chemical and Biological methods of evaluation
6. A brief account of various drug constituents: Carbohydrates, Cardiac glycosides, alkaloids, volatile oils, resins, quinines and steroids with particular reference to Acacia gum, amla, *Coleus*, *Shatavari*, *Rauwolfia*

**UNIT -IV 10 Hours**

7. Medicinal Principles and powder analysis of *Curcuma*, Cloves, Senna, Fennel and Cinnamon

**UNIT-V 10 Hours**

8. Large scale Industrial preparation of Crude Drugs
  - a) Types of reactors used and extraction methods
  - b) Active principles and non-active principle of drugs
  - c) Import and Export potentials of Crude Drugs
  - d) Preparation of crude drugs in indigenous system of medicine
  - e) Quality control test – contamination, Adulteration
9. Regulatory issues in herbal drug development

**C.E.P. XVD/ Practicals (Labs) 4 Hrs/ week 2 Credits**  
**Practical Lab- (Special)- D**

1. Histochemical analysis of the following chemical compounds:
  - a) Alkaloids
  - b) Steroids
  - c) Quinones
  - d) Resins
  - e) Glucosides
  - f) Pigments
  - g) Volatile oils



2. Organoleptic evaluation of the following:

a) *Glycyrrhiza* (Root) b) Ginger (Rhizome) c) Eucalyptus (leaf)  
d) *Terminalia arjuna* (Bark) f) *Strychnos nuxvomica* (seed)

3. Powder analysis. a) Curcuma b) Cloves c) Senna d) Fennel

e) Cinnamon : Market drugs: a) Turmeric b) Chillies c) Coriander

d) Wheat and Jowar

4. Qualitative and Quantitative tests for

a) Alkaloids b) Carbohydrates c) Anthroquinones d) Tannins e) Steroids f) Terpenoids

5. Growing chosen Medicinal plants in an experimental plot and preparation of Crude Drug for commercial market - Project

6. Collection of crude drugs from the market and studying their characteristics

7. Preparation of exhibits

8. Record

## BOTCET-IV : MEDICINAL BOTANY

### Course XVI-D: Post-harvest technology of Medicinal Plants

4 Hours/ week/ 4 credits/ 50 Hours

#### UNIT -I

10 Hours

1. Introduction: Origin, development and evolution of Medicinal Botany
2. Importance of active principles and uses of medicinal plants in different traditional systems of medicine and Allopathy

#### UNIT -II

10 Hours

3. Origin, Historical background. Active principles uses and cultivation practices of the following medicinal plants

a) *Andrographis paniculata* b) *Asparagus racemosus* c) *Bacopa monnieri* d) *Coleus forskohlii*  
e) *Rauwolfia serpentina* f) *Withania somnifera*

4. Origin, Historical background, Active principles uses and cultivation practices (including organic farming) of the following aromatic plants: a) Lemon grass (*Cymbopogon flexuosus*)  
b) Citronella c) Palmarosa d) *Eucalyptus citriodora*

#### UNIT -III

10 Hours

5. Post-harvest Management of Medicinal plants: Drying / Distillation, grading, packing and storage
6. Distillation of aromatic plants: a) Description of distillation UNIT s b) Principles of distillation c) Methods of distillation d) Maintenance and precautions for distillation UNIT s se) Yield and recovery of different aromatic plants

#### UNIT -IV`

10 Hours

7. Conservation of Medicinal Plants; Threatened and endangered Medicinal Plants – in-situ and ex-situ conservation
8. Preparation of Crude drugs in different systems of medicine

#### UNIT-V

10 Hours

9. Financial aspects of medicinal plants: a) Loans b) Subsidies
10. IPR – Patents

#### Reference

1. Cultivation of medicinal and aromatic crops by Farooqui and Sreeramulu..Univ. Press
2. Textbook of Pharmacognosy by Young Ken – Heber W and Young Ken
3. Pharmacognosy of indigenous drugs by K. Raghunathan and Roma Mitra
4. Pharmacognosy- Kokate et al
5. Pharmacognosy- Mohammed Ali
6. Pharmacognosy- Wallis
7. Pharmacognosy- Trease & Evans-1996
8. Pharmacognosy- Shaw and Quadri
9. Pharmacognosy- Tyler, Brady and Robbins
10. Cultivation of Medicinal plants-Purohit & Vyas CBS, 2006
11. Introduction to Medicinal Chemistry (12996). Aler Gingauz. Wiley publications.
12. Medicinal Chemistry (2001). Graham L. Patrick. Oxford University Press

**C.E.P.XVI/D Practicals (Labs)**

**4 Hrs/ week -2 Credits**

***Practical Lab- (Special)***

1. Germination studies and nursery management of medicinal and aromatic plants.  
2. Organoleptic and Microscopic analysis, identification and adulteration check of the following

crude drugs.

a) Leaf drugs *Cassia sps*

b) Root drugs *Rauwolfia serpentina vs. R. tetraphylla*

c) Bark drugs *Holarrhena pubescens vs Terminalia arjuna*

d) Flower drugs *Carthamus tinctorius*

e) Whole plant drugs *Catharanthus roseus*

3. Histochemical identification of the following chemical substances: a) Carbohydrates

b)Proteins, c)Amino acids d)Starch e)Tannins f)Enzymes

4. Histological identification of tissue systems and deposits

a)Epidermis, b)Parenchyma, c)Collenchyma, d)Phloem, e)Xylem, f)Crystals etc.

5. Estimation of oil content in aromatic crops (Clemenger apparatus/SCE)

Record



## BOTCET-V : BIODIVERSITY AND CONSERVATION

Course XVI-E: Biodiversity Conservation and Plant Resources

4 credits/50 Hours

### Unit - I

10 Hours

1. Biodiversity: Definition; factors responsible for determination of Biodiversity;
2. Global concern over climate change.

### Unit - II

10 Hours

3. Levels of Biodiversity: Genetic, Species, Ecological, Evolutionary and Agrobiodiversity.
4. Types of Biodiversity: (Diversity Indices)- Alpha( $\alpha$ ), Beta ( $\beta$ ), Gamma( $\gamma$ ) Diversity.
5. Conservation of Biodiversity
  - a) *In situ* Strategy : National parks, Wild life sanctuaries, biosphere reserves and world heritage sites.
  - b) *Ex-situ* Strategy : By seeds, reclamation, Afforestation, tree Plantation, seed banks, gene banks, cryobanks
  - c) Restoration or Rehabilitation of Endangered species.

### Unit - III

10 Hours

6. Biodiversity at world level: Biodiversity at global and country level, wild plant wealth.
7. Ecosystem diversity in India: Desert, forest, Grassland ecosystem, wetland, Mangroves.
8. Species Diversity: Endemic species, cultivated plants/ Agro- diversity, Endangered plants.

### Unit - IV

10 Hours

9. Threats to Biodiversity:
  - a) Causal factors of threat – Developmental pressure, encroachment, exploitation, human induced disaster, Management of natural and human resources, political and policy issues.
  - b) Threat to Ecosystem, species and genetic Diversity.  
Categories of threats : Endangered, Vulnerable, Rare and Threatened
10. Natural disaster: floods, earthquake, cyclone, landslides, Disaster management.

### Unit - V

10 Hours

11. Plant resources, Concept, Status and Concern
12. Basic concepts of local plant diversity and its economic importance
13. World centres of primary diversity of domesticated plants
14. General account of activities of BSI, NBPGR for conservation and non-formal conservation efforts

## BOTCET-VI : APPLIED PLANT PATHOLOGY

Course XV-F: Applied Mycology 4 hrs/week/4credits/Total 50 Hours

### UNIT- I

10 Hours

#### Introduction Techniques and Information Technology

1. Introduction to Molecular Plant Pathology
2. Molecular techniques in plant pathology, RFLPs, RAPDs, polymerase chain reaction (PCR, RTPCR) - Analysis of PCR products and serological techniques based on immunofluorescence, chromosome karyotyping.
3. Fungal protoplasts and Vegetative compatibility groupings.
4. Information Technology in Plant Pathology: Plant disease clinics; use of database and application of Bioinformatics in plant pathology- a general account.

### UNIT- II

10 hours

#### Plant Pathogen Interactions

5. Recognition: Early events, Adhesion, spore eclosion, adhesion of germ tubes and hyphae factors affecting adhesion, hydrophobins.
6. Elicitors: Distribution, production and nature, fungal wall elicitors (carbohydrates and glycoprotein elicitors) elicitors from plant cell walls, microbial enzyme elicitors, mode of action and diverse plant defense mechanisms.
7. Signal Transduction: Intracellular signals, short distance intercellular signals and systemic signals.
8. Second Messengers: Calcium ion and Calcium dependent enzymes, cyclic AMP, Proteins, H<sub>2</sub>O<sub>2</sub> and Ethylene.
9. Systemic Signal Molecules: Oligogalacturonides, Salicylic acid, Systemin, Jasmonic acid and Lipoxygenases.

### UNIT- III

10 Hours

#### Genetics of Plant Pathogen Interactions

1. Genetics of Plant Disease:
2. Basic features of sexual reproduction; Fungal nucleus; Gene organization
3. Genes and disease; Variability of organisms (Mutation, Heterokaryosis and Parasexuality).
4. Physiological Specialization, origin of races, concept of biological forms.
5. Molecular variability of fungal pathogens.
15. Genetics of virulence in pathogens: Genes involved in pathogenesis; Virulence by pathogens; brief account on plant pathogenic genes in fungi, bacteria and viruses.
16. Types of plant resistance to pathogens:
  - i) Non-host resistance, True resistance (Vertical and Horizontal resistance).
  - ii) Apparent resistance, Gene-for-gene concept, Flor's concept, Breeding resistant varieties.

### UNIT- IV

10 Hours

#### Pathogen Ingress and Plant Resistance

17. Plant defense responses: Generation of signals Local and systemic responses, fungal resistance genes in plants, defense genes and fungal avirulence genes.
18. Plant Immunization: Systemically acquired resistance (SAR) Chemical inducers of plant resistance and Pathogenesis related proteins (PRPs).

### UNIT-V

10 Hours

19. Strategies for cloning plant resistance genes: Vector mediated transformation, Alternative

transformation methods and Identification of transformants.

20. Engineering resistance against fungal and viral pathogens: Coat protein mediated resistance (CPMR) and antisense genes and gene silencing.

21. Antifungal and antibacterial strategies: Candidate genes to combat microbial pathogens (Chitinase, Thionine, Permatins, Lysozymes and Lectins) and antifungal proteins (Ribosome inactivating proteins-RIPs).

### **C.E.P.XV F Practicals (Labs)**

**4 Hrs/ week 2 Credits**

#### ***Practical Lab- (Special)***

1. Isolation and separation of fungal nucleic acids and proteins by gel electrophoresis.

2. RFLPs of fungal nucleic acids and RAPDs of fungal DNA.

3. Amplification of Fungal DNA by PCR.

4. Fungal Protoplast isolation.

5. Elaboration of phytoalexins by TLC methods.

6. Record and Herbarium of diseased plants.

#### **Reference Books:**

1) Agrios, G.N. 1999, Plant Pathology. Academic press.

2) Alexander, N. Glazer & Hiroshi Nikaido, 1995. Microbial Biotechnology, W.H. Freeman and Company.

3) Bau, A.N. & Giri, B.K. 1993. The essential of viruses, vectors and plant diseases. Wiley Eastern Limited.

4) Bernard R. Glick & Jack J. Pasternak. 1996, Molecular Biotechnology, Panima Publishing Company.

5) Bridge, P., Jeffriens, P. and Morse, D.R., 1998, Information technology, plant Pathology and Biodiversity, CAB international Publications.

6) Bridge, P.D. 1995, Molecular Variability of Fungal Pathogens, CABI Publ.

7) Bridge, P.D., Arora, D.K., Reddy, C.A. & Elander, R.P. 1998. Applications of PCR in Mycology,

8) Callow, J.A. 1983. John Wiley & Sons, Biochemical Plant pathology.

9) Chandanwala, K. 1986 Introduction of Plant pathology Anmol Publications Pvt. Ltd. New Delhi.

10) Dubey, R.C. 1995. A Text Book of Biotechnology, S. Chand & Company Ltd.

11) Greg J. Boland & Kuykendall, L.D. 1998. Plant Microbe Interactions and Biological Control. Marcel Dekker Inc.

12) Gurr, S.J. & Mc. Pherson, M.J. & Bowles, D.J. 1992. Molecular Plant Pathology, Vol. I & II Oxford

13) Horst W. Doelle, 1994, Microbial Process Development, World Scientific

14) Marshall, G. & Walters, D. 1994 Molecular Biology in Crop Protection, Chapman & Hall.

15) Mehrotra, R.S. 1991 Plant pathology, Tata McGraw – Hill Publishing Comp Ltd.

16) Natish, S. Chopra, V.L. & Ramachandran, S. 1994. Biotechnology in Agriculture Oxford and IBH

Publishing Company.

17) Natish, S., Chopra, V.L. & Ramachandran, S. 1994 Biotechnology Agriculture Oxford and IBH Publishing Company.

## BOTCET VI: APPLIED PLANT PATHOLOGY

**Course XVI F:            Molecular Plant Pathology            4hrs/week/4 Credits/ Total 50 hrs**

### UNIT- I

**10 Hours**

1. Introduction and History of Plant Pathology
2. Classification of plant diseases: Symptomology of Fungal, Bacterial, Viral and Phytoplasmal diseases
3. Plant diseases caused by Phanerogamic plant parasites- *Loranthus*, *Orobanche*, *Striga* and *Cuscuta*.
4. Nematode disease - Root knot of tomato caused by *Meloidogyne*
5. General account of post-harvest fungal diseases of food crops, fruits and vegetables and their management.

### UNIT- II

**10 Hours**

#### **Plant diseases caused by Bacteria, Viruses, Viroids, Phytoplasma and Spiroplasmas**

6. Plant diseases caused by Bacteria:
  - a) Wildfire of Tobacco
  - b) Angular leaf spot of Cotton
  - c) Leaf spot of Mango
  - d) Wilt of Potato
  - e) Wilt of Tomato
  - f) Soft rot and Scab of Potato
7. Plant diseases caused by Viruses & Viroids:
  - a) Bhindi vein clearing
  - b) Papaya leaf curl
  - c) Bunchy top of Banana
  - d) Rice Tungro
  - e) Bud necrosis of Groundnut
  - f) Bean common mosaic
  - g) Potato spindle tuber
8. Plant diseases caused by Phytoplasmas and Spiroplasmas:
  - a) Grassy shoot of Sugarcane c) Sandalwood spike
  - b) Little leaf of Brinjal d) Sesamum phyllody

### UNIT- III

**10 Hours**

#### **Fungal Diseases of Cereals**

9. Cereals:
  - a) Bakanae disease of Rice
  - b) Sheath blight disease of Rice
  - c) Loose smut of Wheat
  - d) Karnal bunt of Wheat
  - e) Grain smut of Sorghum
  - f) Loose smut of Sorghum
  - g) Downy mildew of Bajra
  - h) Common smut of Maize



#### UNIT-IV

10 Hours

##### **Fungal diseases caused by Plantation crops, Pulses and oil seeds,**

##### 10. Plantation crops:

- a. Coffee Rust
- b. Blister blight of Tea
- c. Stem rot of Rubber

##### 11. Pulses and Oil Seeds:

- a) Pigeon pea Wilt b) Chick pea Blight
- c) Rust of Groundnut
- d) Sunflower Rust
- e) Linseed Rust
- f) Coconut Bud rot

#### UNIT- V

10 Hours

##### **Fungal Diseases of Fruits, Vegetables and Cash crops**

##### 12. Fruits:

- a) Downy mildew of Grapes;
- b) Powdery mildew of grapes
- c) Mango Anthracnose
- d) Citrus Gummosis

##### 13. Vegetables:

- a) Powdery mildew of Cucurbits
- b) Leaf spot of Tomato
- c) Leaf spot of Brinjal
- d) Club root of Crucifers
- e) Chilli Die-back

##### 14. Cash crops:

- a) Whip smut of Sugarcane
- b) Cotton Wilt
- c) Damping off of Tobacco
- d) Black Shank of Tobacco
- e) Turmeric Leaf spot

##### **C.E.P.XVI F Practicals (Labs)**

**4 Hrs/ week 2 Credits**

##### ***Practical Lab- (Special)***

1. Diagnosis of plant diseases and proof of pathogenicity according to Koch's postulates.
2. Measurement of plant diseases- Disease scoring.
3. Plant disease diagnosis by studying symptoms in the field.
4. Preparation of semi-permanent slides of diseased material, eg. Leaf spots, blights, mildews, rots, wilts, rusts and smuts.
5. Micrometry and standardization of microscope.
6. Measurement of fungal spores and mycelium and camera lucida drawings
7. Record and Herbarium of diseased plants.

## CET-VII : COMPUTER SCIENCE & BIOINFORMATICS

**Course XIII -G: Elementary Computers Knowledge 4 hrs/week/4 Credits/ Total 50 Hours**

### **Unit -I 10 Hours**

Basics of Computer: Introduction to Computer, Generation of computers, Classification of computers Peripheral, Characteristics of Computer, Hardware, Software, Introduction to operating system: functions, Services Types of OS, Number system: Binary, Octal and Hexadecimal number systems, Introduction to Logic Gates (AND, OR, NOT, NAND, NOR, XOR XNOR).

### **Unit-II 10 Hours**

Information System, Types of IS ,Need of IS, Development of IS Decision Support System ,E Commerce, Types of E-Commerce, Traditional Commerce Use of E-Commerce, Electronic Payment System, Credit/Debit cards, Intrusion Detection System

### **Unit-III 10 Hours**

MS-WORD : .File, edit, cut, copy, paste, standard tool bar, formatting, toolbar, paste special, hyper link, clear, select all, find, replace, go to, Header & Footer, page, break, date & time, auto text, symbol, picture & word art, Fonts, paragraph, change case, Spelling & grammar, word count, auto correct, Table, sort EXCEL : New, open, save, (File Menu), concept of book sheet, selecting whole columns & rows. Cut, copy, paste, paste special, fill clear, delete, delete sheets, find replace, go to Toolbar, insert cells, rows, columns. Chart, format cells, autocorrect, Spell check, sort. POWERPOINT: Introduction to Power point, slideshow, insert new slide, duplicate slide, apply design, Slide Show.

### **Unit-IV 10 Hours**

Introduction to internet, Introduction to DBMS, Computer Networks, Types of Networks LAN/MAN/WAN, Network Topology, OSI Model/TCP IP Model, Firewalls, VPN, Cryptography , Public Key, Private key, Encryption, Decryption, Digital Signature,

### **Unit-V 10 Hours**

Introduction to Cyber Security, Introduction to Information Security, Role of Security in Internet and Web Services Need of Information Security Threats- Viruses, Phishing and Identity TheftWorms, Trojan House, IT ACT, IPR, Software Licenses, Copy Right Law, Patent Law.



**OPEN ELECTIVES (Offered by the department for the students of other courses)**

**OET -I: DISASTER MANAGEMENT**

**4 hrs/ week/ 4 Credits/ 50 hrs**

**UNIT- I**

**10 Hours**

Introduction to Disasters: Concepts, and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks.

**UNIT- II**

**10 Hours**

Disasters: Classification, natural hazards and Man-made disasters, Causes, Impacts (including social, economic, political, environmental, health, psychosocial, etc.) Differential impacts- in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics and climatic change.

**UNIT- III**

**10 Hours**

Approaches to Disaster Risk reduction: Disaster management cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural-nonstructural measures, roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders. CBRN disaster, NDMA, NDRF, NIDM, STATE DM.

**UNIT- IV**

**10 Hours**

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources

**UNIT-V**

**10 Hours**

Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)

**Suggested Reading list:**

Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press, 2000

Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper no. 8, 2008

Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.

Coppola P Damon, 2007. Introduction to International Disaster Management,

Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.

Cuny, F. 1983. Development and Disasters, Oxford University Press.

Document on World Summit on Sustainable Development 2002.

Govt. of India: Disaster Management Act 2005, Government of India, New Delhi.

Government of India, 2009. National Disaster Management Policy,

Gupta Anil K, Sreeja S. Nair. 2011 Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi

Indian Journal of Social Work 2002. Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.

Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur

Kapur Anu 2010: Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi.

Parasuraman S, Acharya Niru 2000. Analysing forms of vulnerability in a disaster, The Indian Journal of Social Work, vol 61, issue 4, October

**OPEN ELECTIVES (Offered by the department for the students of other courses)**

**OET -II: ENVIRONMENTAL AWARENESS**

**4 hrs/ week/ 4 Credits/ 50 hrs**

**UNIT- I**

**10 Hours**

1. Multidisciplinary nature of environmental studies, Definition, scope and importance, Need for public awareness.

**UNIT- II**

**10 Hours**

2. Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources.

**UNIT- III**

**10 Hours**

3. Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers.

4. Energy flow in the ecosystem.

5. Ecological succession.

6. Food chains, food webs and ecological pyramids.

7. Introduction, types, characteristic features, structure and function of the following ecosystem:-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**UNIT- IV**

**10 Hours**

8. Social Issues and the Environment

9. From Unsustainable to Sustainable development

10. Urban problems related to energy

11. Water conservation, rain water harvesting, watershed management

12. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

13. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Public awareness.

**UNIT- V**

**10 Hours**

14. Human Population and the Environment, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.



**Tentative List of Open Electives offered by Campus Departments in semester II and III, respectively for CBCS students of 2016-18**

**History:**

1. Indian rituals and Karma
2. Indian Culture and heritage

**Urdu:**

1. Urdu Proficiency
2. Mass Media

**Psychology:**

1. Personality Development and Communication Skills
2. Yoga and Meditation

**Chemistry:**

1. Green Chemistry
2. Analysis and identification of chemicals

**Mathematics:**

1. Optimization techniques
2. Basic cryptography

**Zoology:**

1. Poultry Science
2. Wild life and Forestry

**Toxiology:**

1. Chemical disaster Management
2. Forensic toxicology

**Statistics:**

1. Applied Statistics
2. Essential Statistics

**Physics:**

1. Introduction to Nanotechnology
2. Electron Microscopy

**Botany:**

1. Disaster Management
2. Environmental Awareness

**Microbiology:**



1. Food Safety and Quality Control
2. Public Health and Hygiene

**English:**

1. Human Society
2. Personality development and Communication skills

**Hindi:**

1. Functional Hindi
2. Hindi journalism

**Economics:**

1. Basic economics
2. Developments in Indian Economics

**Genetics and Plant Breeding:**

1. Crop Physiology
2. Crop Biochemistry

**Sociology:**

1. Rural Development: concepts and Dimensions
2. Social Change in India

**Political Science:**

1. Human rights
2. Constitution of India