

# UNIVERSITY OF LADAKH

Approved Vide: NO:UOL/2020/DDA-01-398 Dated:1<sup>st</sup> of Dec.,2020

## Syllabus of Botany for Undergraduate course under Choice Based Credit System

**Subject: Botany**  
**Subject Code:UGBO**  
**Semester: 1<sup>st</sup>**

**Course title: Biodiversity (Microbes, Algae, Fungi, Pteridophytes and Gymnosperms)**  
**Course Code: UGBO-C 101** **Core Course Botany Paper -1**  
**Maximum marks: 100 (External = 90 and Attendance= 10)** **Credits: 4**

### **Unit 1: Microbes (13 Lectures)**

**Viruses:** Discovery, general structure, replication, DNA virus (T-phage); lytic and lysogenic cycle, RNA virus (TMV). Economic importance.

**Bacteria:** General characteristics and cell structure; Reproduction—vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

### **Unit 2: Fungi (15 lectures)**

General characteristics, classification (Alexopolous, Mims & Blackwell), cell wall composition, nutrition and reproduction; life cycle of *Rhizopus* (Zygomycota), *Alternaria* (Ascomycota), *Agaricus* (Basidiomycota) and *Morchella* (Ascomycetes).

**Symbiotic Associations:** Lichens and Mycorrhiza - general account and significance.

### **Unit 3: Algae and Bryophytes (15 Lectures)**

**Algae:** General characteristics, classification of algae (Round 1965), range of thallus organization; morphology, reproduction and life cycle of *Nostoc*, *Oedogonium*, *Batrachospermum*; Economic importance of algae.

**Bryophytes** -General characteristics, Proskauer's classification (upto family); morphology, anatomy and reproduction(excluding developmental details) of *Marchantia* and *Funaria*; Economic importance of bryophytes.

### **Unit 4: Pteridophytes and Gymnosperms (17 Lectures)**

**Pteridophytes** - General characteristics; classification of pteridophytes (Sporne 1965); Morphology, anatomy and reproduction (excluding developmental details) of *Equisetum* and *Dryopteris*; heterospory and origin of seed habit;

**Gymnosperms** - General characteristics, classification—Christenhusz et al. 2011 (upto family); Morphology, anatomy and reproduction (excluding developmental details) of *Cycas* and *Ephedra*; Economic importance of gymnosperms.

**Paleobotany:** Introduction to paleobotany; General account of *Williamsonia*.

**Practical:**

**Course Title: UGBO-L 101**

**Credits: 2**

**Maximum Marks: 50 (Internal Continuous Assessment =25 and External Practical**

**Exam=25)**

- i. Models / photographs of viruses – T-Phage and TMV, drawing / photograph of lytic and lysogenic Cycle.
- ii. Types of bacteria from temporary/permanent slides/photographs; Gram staining
- iii. Study of vegetative and reproductive structures of *Nostoc*, *Oedogonium*, *Ectocarpus* and *Batrachospermum* through temporary preparations and permanent slides.
- iv. *Rhizopus*, *Alternaria* and *Morchella*: Asexual stages from temporary mounts and sexual structures through permanent slides.
- v. *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*.
- vi. Study of growth forms of lichens (crustose, foliose and fruticose)
- vii. *Marchantia*- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
- viii. *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
- ix. *Equisetum*- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry - temporary slides); t.s. rhizome (permanent slide).
- x. *Dryopteris*- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
- xi. *Cycas*- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
- xii. *Ephedra*: morphology, t.s. stem, t.s. leaf, l.s. male strobilus, l.s. female flower, l.s. ovule, l.s. mature seed.

## **Suggested Readings**

1. Alexopoulos, C.J. and Mims, C.W. 2002. Introductory Mycology. 5th edition. John Wiley and Sons, New York.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4<sup>th</sup> edition.
3. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
4. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2<sup>nd</sup> edition.
5. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
6. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
7. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
8. Singh, R.S. 1990. Principles of Plant Pathology. Oxford and IBH Publishers, New Delhi
9. Singh, V., Pande, P. C. and Jain, D. K. 2010. Diversity of Microbes and Cryptogams. Rastogi Publications, Meerut, India.
10. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10<sup>th</sup> edition.
11. Vashishta, B.R., Sinha, A.K. and Singh, V.P. 2008. Botany for Degree Students-Algae. S. Chand and Company Pvt. Ltd., New Delhi.
12. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
13. Vashishta, B.R, Sinha, A.K., Kumar, A Botany for Degree Students- Bryophyta. S. Chand and Company Pvt. Ltd., New Delhi.

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## **Syllabus of Botany for Undergraduate course under Choice Based Credit System**

**Subject: Botany**

**Subject Code:UGBO**

**Semester: II**

**Credits: 6**

**Core Course Botany Paper -II**

**Course title: Plant Ecology and Taxonomy**

**Course Code: UGBO-C 201**

**Credits: 4**

**Maximum marks: 100 (External = 90 and Attendance= 10)**

### **UNIT 1: Ecology and Plant communities**

**[14 lectures]**

Introduction to Ecology, Concept of habitat and niche, Soil formation and Soil Profile.  
Characteristics of population, Growth curves, Species interaction.  
Plant communities: Characteristics, Ecotone and edge effect.  
Succession: Processes and types

### **UNIT 2: Ecosystem and Phytogeography**

**[16 lectures]**

Structure of Ecosystem; energy flow trophic organisation; Food chains and food webs,  
Ecological pyramids production and productivity;  
Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous  
Phytogeography: Biogeographical zones of India; Concept of Endemism

### **UNIT 3: Plant Taxonomy and Classification**

**[16 lectures]**

Introduction to plant taxonomy;  
Types of classification: artificial, natural and evolutionary  
Classification system: Bentham Hooker (up to series), Angiosperm Phylogeny Group (APG)  
up to order level  
Numerical Taxonomy: Operational Taxonomic Units (OTUs), Character Weighing and  
Coding, Cluster Analysis; phonograms and Cladograms (definitions and differences)  
Roles of Herbarium, important herbaria and botanical gardens of the world and India;

### **UNIT 4: Identification and Nomenclature**

**[14 lectures]**

Documentation: Flora, Keys: single access and multi-access, taxonomic evidences from  
cytology phytochemistry and molecular data  
Taxonomic hierarchy- ranks, categories and taxonomic groups;  
Botanical Nomenclature: History and principals of ICN, Binomial system of nomenclature,  
Typification, author citation, valid publication, principal of priority.

**Practicals:(Credits 2)****Course Code: UGBO-L 201****Maximum Marks: 50 (Internal Continuous Assessment=25 and External Practical Exam= 25)**

1. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid fieldtest.
2. To determine the moisture content and water holding capacity of of grassland and forestsoil
3. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
4. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distributionlaw.
5. Studyofvegetativeandfloralcharactersofthefollowingfamilies(Description,V.S.flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):Brassicaceae -Brassica, Alyssum / Iberis; Asteraceae -Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax; Solanaceae -*Solanumnigrum*; Lamiaceae-Salvia, *Ocimum*; Liliaceae - Asphodelus / Lilium /Allium.
6. Botanical exploration/Plant collection tour.
7. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the recordbook).

**Suggested Readings**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4thedition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Chapman, JL and Reiss, MJ; (1997) Ecology Principals and Applications. Cambridge University Press, London
4. ColinvauXP (1993), Ecology. John Wiley, New York.
5. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
6. Judd, S, Walter et al. (2008), Plant Systematics: A Phylogenetic Approach. Sinauer Associates, Inc. Sunderland USA
7. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition
8. Wilkens GE (2004), Economic Botany, Principals and Practices. Kluwer Publishers, Niethelands
9. Stilling P (2001), Ecology:Theories and Applications. Printice Hall Inc.

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## **Syllabus of Botany for Undergraduate course under Choice Based Credit System**

**Subject: Botany**

**Subject Code: UGBO**

**Semester: III**

**Credits: 6**

**Core Course Botany Paper -III**

**Course Title :Plant Anatomy and Embryology Course**

**Code: UGBO-C 301**

**Credits: 4**

**Maximum marks: 100 (External = 90 and Attendance= 10)**

### **UNIT 1: PLANT TISSUES AND ORGANS**

**(12**

**Lectures)**

- ix. Plant tissue system; Meristematic and Permanent tissues (structure, types and functions). Organization of root and shoot apical meristem- Apical Cell theory, Histogen theory, Tunica and corpus theory, Quiescent centre.
- x. Plant organs: Structure of a typical dicot and monocot root, stem and leaf.

### **UNIT II: SECONDARY GROWTH AND LEAF**

**(16**

**Lecture)**

1. Secondary growth: Cambium- origin, types and function. Secondary growth in dicot root and stem, Periderm. General account of wood structure (Heart wood and Sap wood, Annual rings). Secondary growth in monocot (Dracaena).
2. Leaf origin & development, Nodal anatomy, Leaf traces and leaf gaps

### **UNIT III: REPRODUCTION IN FLOWERING PLANTS (I).**

**(16**

**Lectures)**

1. Structural organization of flower, Development and structure of anther, male gametophyte (pre and post pollination development). Structure and types of ovule, Development and structure of typical embryo sac, Types of embryo sac.
2. Pollination and types of pollination, floral modifications favoring self and cross pollination, Agents (Abiotic and biotic) responsible for pollination, Pollen-pistil interaction, Self-incompatibility, Double fertilization.

### **UNIT IV: REPRODUCTION IN FLOWERING PLANTS (II)**

**(16**

**Lectures)**

- ii **Embryo and Endosperm:** Endosperm development, dicot and monocot embryo (*Capsella bursa-pestoris*, *Triticum*), Polyembryony, Structure and development of fruit, Seed structure (Bean and Maize), seed dormancy and seed dispersal mechanism.
- iii **Apomixis:** Apomixis (Agamospermy and vegetative propagation).

**Practicals:(Credits 2)****Course Code: UGBO-L 301****Maximum Marks: 50 (Internal Continuous Assessment=25 and External Practical Exam= 25)**

1. Study of meristems through permanent slides/bio-visual aids.
2. Tissues (Parenchyma, Collenchymas and Sclerenchyma) through permanent slides/photograph.
3. Root: Monocot: Zea mays; Dicot: Helianthus (preparation of temporary mount and permanent slides) Secondary: Helianthus (Permanent slides only).
4. Stem: Monocot: Zea mays; Dicot: Helianthus (preparation of temporary mount and permanent slides) Secondary Helianthus (Permanent slides only).
5. Leaf: Dicot and monocot leaf (preparation of temporary mount and permanent slides).
6. Structure of anther (young and mature), Tapetum -amoeboid and secretory (through permanent slides/materials/ bio-visual aids).
7. Types of Ovules; anatropous, orthotropous, circinotropous, amphitropous, campylotropous (through permanent slides/materials/ bio-visual aids).
8. Female gametophyte; Polygonum (monosporic) type of embryo sac development (through permanent slides/ photographs).
9. Ultrastructure of mature egg apparatus cells through electron micrograph.
10. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) through photograph/specimens.
11. Dissection of embryo/endosperm from developing seeds.
12. Calculation of percentage of germinated pollen in a given medium.

**Suggested Readings**

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of angiosperms. Vikas Publication House Pvt.Ltd. New Delhi. 5th Edition.
2. Singh, V., Pande, P. C. and Jain, D.K. 2010. Structure, Development and Reproduction in Angiosperms. Rastogi Publications, Meerut, India.
3. Maheshwari, P. 1950. An Introduction to the Embryology of Angiosperms. McGrawHill, New York.
4. Pandey, A.K. 1997. Introduction to Embryology of Angiosperms. CBS Publishers and Distributors, New Delhi.
5. Pandey, S.N. and Chadha. 1996. Embryology. Vikas Publishing house, New Delhi.
6. Cutler, D.F., Botha, T. and Stevenson, D.W. 2008. Plant anatomy: An applied approach. Wiley-Blackwell Publishers.
7. Evert, R.F. and Esau, K. 2006. Esau's Plant Anatomy. John Wiley and Sons.
8. Pandey, B.P. (2001). Plant Anatomy. S. Chand and Company, New Delhi.
9. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/ Cummings Publisher, USA
10. Pandey, B.P. (2010). Modern practical botany volume II. S. Chand & Company Ltd. New Delhi.
11. Bendre, A. and Kumar, A. (2012). A text book of practical botany volume II. Rastogi publications Meerut.

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## **Syllabus of Botany for Undergraduate course under Choice Based Credit System**

**Subject: Botany**

**Subject Code:UGBO**

**Semester:IV**

**Credits: 6**

**Core Course Botany Paper –IV**

**Course title: Plant Physiology and Metabolism (Theory)**

**Credits: 4**

**Course Code: UGBO-C 401**

**Maximum marks: 100 (External = 90 and Attendance= 10)**

### **UNIT 1: PLANT-WATER RELATIONS AND TRANSPORT**

**(Lectures-18)**

- 1. Plant Water Relations:** water potential and its components; Transpiration and its significance; Factors affecting transpiration; Ascent of Sap, Pressure flow model; Phloem loading and unloading.
- 2. Mineral nutrition:** Essential elements, Criteria of essentiality of elements. Macro and micronutrients (role and deficiency diseases). Active and passive transport.

### **UNIT II: PHOTOSYNTHESIS (Lectures-14)**

- Chloroplast and photosynthetic pigments. Light harvesting complexes, Photosystem I and II, Electron transport (cyclic and non-cyclic) and mechanism of ATP synthesis.
- C<sub>3</sub>, C<sub>4</sub> and CAM** pathways of carbon fixation, Photorespiration.

### **UNIT III: RESPIRATION, NITROGEN METABOLISM AND ENZYMES (Lectures-14)**

- Respiration:** Mitochondria, Glycolysis, Anaerobic respiration, TCA cycle, Electron Transport system, Cyanide resistant pathway, Oxidative phosphorylation,
- Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.  
**Enzymes:** Classification and properties.

### **UNIT IV: PLANT GROWTH REGULATORS AND SECONDARY METABOLITES (Lectures-14)**

- Plant growth regulators:** Discovery and physiological roles of Auxins, Gibberellins, Cytokinins, ABA and Ethylene.
- Secondary metabolites:** Biosynthesis of terpenes, phenols and nitrogen containing alkaloids and their roles.



**Practicals:(Credits 2)**

**Course Code: UGBO-L 401**

**Maximum Marks: 50 (Internal Continuous Assessment=25 and External Practical Exam= 25)**

1. Determination of osmosis by using potato osmometer.
2. To demonstrate the movement water via xylem.
3. To study the phenomenon of plasmolysis.
4. To study the phenomenon of transpiration by bell-jar method.
5. To demonstrate rate of transpiration by using Ganong'spotometer.
6. To demonstrate that oxygen is evolved during photosynthesis by inverted funnel method.
7. To demonstrate that liberation of CO<sub>2</sub> during aerobic respiration.
8. Calculation of stomatal index and stomatal frequency.
9. Separation of photosynthetic pigments by paper chromatography.
10. To demonstrate grafting.

**Suggested Readings**

1. Taiz, L., Zeiger, E., (2010). Plant Physiology.Sinauer Associates Inc., U.S.A. 5<sup>th</sup> Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology.John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual.Narosa Publishing House, New Delhi.
4. Dennis,D.T., Turpin, D.H., Lefebvre,D.D. and Layzell (eds.). 1997: Plant Metabolism (2nd Edition), Longman, Essex, England.
5. Galston, A.W. 1989: Life Processes in Plants, Scientific American Library, Springer-Verlag, New York, USA.
6. Hopkins, W.G., 1995: Introduction to Plant Physiology, John Wiley & Sons, Inc., New York, USA.
7. Mohr, H. and Schopfer, P. 1995: Plant Physiology. Springer-Verlag, Berlin Germany.
8. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology.4th Edition. Wadsworth Publishing Company, Inc. California, USA.
9. Sharma, O.P and Dixit Shivani. 2008. Practical Botany –III .PragatiPrakashan, Meerut, India.

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## **Syllabus of Botany for Undergraduate course under Choice Based Credit System**

**Subject: Botany**

**Credits: 6**

**Subject Code: UGBO**

**Semester: V**

**Core Course Botany Paper – V**

**DISCIPLINE SPECIFIC ELECTIVES (DSEs)**

**Course title: CELL AND MOLECULAR BIOLOGY(Theory)**

**Credits: 4**

**Course Code: UGBO-DE 501**

**Maximum marks: 100 (External = 90 and Attendance= 10)**

### **Unit 1: Cell as a unit of Life, Cell wall and Plasma membranes (18 lecture)**

Principal of microscopy; light microscopy (simple and compound microscope). Principle of electron microscopy- scanning and transmission electron microscopy.

The cell theory; prokaryotic and eukaryotic cells; properties of cell; eukaryotic cell components. Bio-membranes; structure and function, fluid mosaic concept, fluidity of bio-membranes; membrane proteins and their functions; carbohydrates in the plasma membrane.

Cell wall-structure and functions.

### **Unit 2: Cell Organelles (16 lecture)**

Non-membranous organelles: Structure and functions of ribosomes

Single membrane bound organelles: Endoplasmic reticulum, Golgi bodies and Lysosomes, Peroxisomes and Glyoxisomes.

Double membrane bound organelles: Structure, functions of Mitochondria, Semi-autonomous nature of Mitochondria and Chloroplast, Endosymbiont hypothesis, mitochondrial and chloroplast DNA.

Nucleus: Nuclear Envelope- structure of interphase nucleus; chromatin material, euchromatin and heterochromatin, nucleolus.

### **Unit 3: Cell Cycle & Genetic Material (14 lecture)**

Overview of Cell cycle, mitosis and meiosis. DNA- Watson and Crick's model, Griffith's and Avery's transformation experiments. Hershey-Chase bacteriophage experiment

DNA- structure, types, replication (Prokaryotes, Eukaryotes).

### **Unit 4: Gene Expression & Gene Regulation (12 lecture)**

Types of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Transcription and translation in prokaryotes, genetic code.

Gene regulation in Prokaryotes: Lac operon and Tryptophan operon

**Practicals:(Credits 2)**

**Course Code: UGBO-L 501**

**Maximum Marks: 50 (Internal Continuous Assessment=25 and External Practical Exam= 25)**

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. Study of mitosis and meiosis (temporary mounts and permanent slides).
5. Study the effect of temperature, organic solvent on semi permeable membrane.
6. Study of plasmolysis and deplasmolysis in onion peelings.
7. Study the structure of nuclear pore complex by photograph.
8. Study of special chromosomes (polytene&lampbrush) either by slides or photographs.
9. Study DNA packaging by micrographs.
10. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

**Suggested Readings**

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Alberts, James Watson, Dennis Bray, J. Lewis. Molecular Biology of Cell. Garland Science publishers.
6. Bruce Alberts & Lewis. Essential Cell Biology. Garland Science.
7. Watson J.D. Molecular Biology of the Gene. 7th Edition. Melno Park Calif, Benjamin/Cummings
8. Lodish et al. Molecular Cell Biology. W.H. Freeman and Co.
9. David E. Sadava. Cell Biology: Organelle Structure and Function. Jones and Bartlett Pub.
10. David Freifelder. Molecular Biology.
11. Powar. C.B. Cell Biology, Himalaya publishing House.
12. Gupta, P.K. Genetics, Rastogi Publications, Meerut, UP.
13. Singh, B.D. 2009. Genetics, 2<sup>nd</sup> Edition, Kalyani Publishers, New Delhi.

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**Syllabus of Botany for Undergraduate course under Choice Based Credit System**

**Subject: Botany**

**Subject Code: UGBO**

**Semester: VI**

**Course title: Economic Botany and Biotechnology (Theory )**

**Credits: 4**

**Course Code: UGBO-DE 601**

**Core Course Botany Paper -6**

**Maximum marks: 100 (External = 90 and Attendance= 10)**

## **Unit – 1: Origin of cultivated plants(15 hours)**

Concept of centres of origin, their importance with reference to Vavilov's work;

Crop domestication and loss of genetic diversity; importance of germplasm diversity.

**Cereals:** Origin, morphology and uses of Wheat, Rice and Barley. Brief account of millets and Pseudo-cereals (Buckwheat).

## **Unit – 2: Legumes, Spices and Sugars (14 hours)**

**Legumes:** Introduction, importance of *Pisum sativum* (local pea), *Phaseolus vulgaris* (Kidney Bean), *Cicer microphyllum* (Himalayan Chickpea).

**Spices and condiments:** Introduction; systematic position, morphological features and uses of *Curcuma domestica*; *Syzygium aromaticum*; *Piper nigrum*; *Elettaria cardamomum* & *Carum carvi*; *Bunium persicum*. *Allium carolinianum*.

General account of Starch and Sugars with special reference to Potato & Sugar cane.

## **Unit – 3: Beverages, Oils, fibres & Medicinal plants (15 hours)**

**Beverages:** Introduction; processing and uses of Seabuckthorn and Barley (Alcoholic Beverage).

General account of Oils and Fats; extraction methods of essential oils; Systematic position and uses of Brassica, Coconut, Apricot.

**Fibres:** Classification of fibres (Based on origin); morphology, extraction & uses of Cotton.

**Medicinal & Narcotic Plants:** Systematic position, chemical constituents and uses of *Arnebia euchroma*, *Dactylorhiza hatagirea*, *Podophyllum hexandrum* & *Aconitum heterophyllum*.

## **Unit – 4: Biotechnology & Biotechnological techniques: (16 hours)**

Introduction & importance of Biotechnology; brief account of plant tissue culture, concept of somaclonal variation; germplasm storage (cryopreservation). Concept of restriction enzymes.

**Cloning Vectors for recombinant DNA:** Plasmids (Ti&Ri plasmids of *Agrobacterium*), Transposons (Ac & Ds of Maize).

**Biotechnological techniques:** Gene transfer techniques in plants, transgenic plants with special reference to Bt- Cotton & Golden rice; Blotting techniques (Northern, Southern and Western).

Principle and applications of Polymerase Chain Reaction (PCR); Hybridoma & monoclonal Antibodies.

**Practical :(Credits 2)**

**Course Code: UGBO-L 601**

**Maximum Marks: 50 (Internal Continuous Assessment =25 and External Practical Exam=25)**

1. Study of economically important plants: Barley, Rice & Potato– (Habit sketch, starch grains and micro- chemical tests)
2. Study the distribution of oil bodies in some oil yielding seeds – Apricot, Walnut, Ground nut, Sarson.
3. Study the surface fibres (Cotton) and Bast fibres (Hemp).
4. Study the different types of spices & condiments – Piper, Curcuma, Clove, Cardamom, Caraway, Black Zera, Wild garlic.
5. Preparation of basic standard culture media from dry powdered media.
6. Study through photographs the 4-step and 3-step micro-propagation of plant material.
7. Study through photographs the process of DNA fingerprinting.
8. Study through photographs the procedures Blotting techniques.

**Suggested readings:**

1. Bhojwani, S. S. & Razdan, M. K. (1996). Plant tissue culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Chrispeels, M. J. & Sadava (2003). Plants, Genes and Agriculture. Jones and Bartlett Publishers.
3. Glick, B. R., Pasternak, J. J. (2003). Molecular Biotechnology- Principles & applications of recombinant DNA. ASM Press, Washington.
4. Kochhar, S. L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
5. Panday, B. P. (1999) Economic Botany. S. Chand and Company Ltd.
6. Sambamurthy A.V.S.S. & Sambamurthy (2000). Economic Botany of Crop Plants. Asiatic Publishers Inc.
7. Simmonds N. W. (1984). Evolution of crop plants (edited by Norman Willison Simmonds). Longman Inc., New York.
8. Wickens, G. E. (2001). Economic Botany- Principles & Practices. Kulwer Academic Publishers. The Netherlands.
9. Chourasia, O.P., Ahmed, Z. & Ballabh, B (2007). Ethnobotany & Plants of Trans-Himalaya. Satish Serial Publishers.