

CBCS SYLLABUS
FOR
THREE YEARS UNDER-GRADUATE COURSE
IN
BOTANY (PROGRAMME)
(w.e.f. 2017)



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2. Scheme for CBCS Curriculum

2.1 Credit Distribution across Courses

		Credits	
Course Type	Total Papers	Theory + Practical	Theory*
Core Courses	12	12*4 =48	14*5 =70
		12*2 =24	14*1=14
Discipline Specific Electives	6	6*4=24	4*5=20
		6*2=12	4*1=4
Ability Enhancement Language Courses/ ENVS	2	1*2=2 (ENG / MIL) 1*4=4 (ENVS)	1*2=2 (ENG / MIL) 1*4=4 (ENVS)
Skill Enhancement Courses	4	4*2=8	4*2=8
Totals	24	122	122

*Tutorials of 1 Credit will be conducted in case there is no practical component

**1.2 Scheme for CBCS Curriculum in Botany (Programme)****SEMESTER – I**

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SPBOT/101/C-1A	Plant Biodiversity: Microbes, Algae, Fungi and Archegoniate (Bryophyta, Pteridophyta, Gymnosperm) Theory and Practical	6 (T 4+P 2)	10	40 (T 25+P 15)	50	4	N.A.	4
/102/ C-2A	From another discipline-2	6	10	40	50			
/103/ C-3A	From another Discipline-3	6	10	40	50			
ACSHP/ 104/ AECC-ENV	Environmental Studies	4	10	40	50	N.A	N.A.	N.A.
Total in Semester - I		22	40	160	200			

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER –II

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SPBOT/ 201/C-1B	Plant Ecology, Morphology and Taxonomy (Theory and Practical)	6 (T 4+P 2)	10	40 (T 25+P 15)	50	4	N.A.	4
/202/ C-2B	From another Discipline - 2	6	10	40	50			
/ 203/C- 3B	From another Discipline - 3	6	10	40	50			
ACSHP/204/ AECC-E/MIL	English/MIL	2	10	40	50	N.A	N.A.	N.A.
Total in Semester - II		20	40	160	200			

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

**SEMESTER – III**

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SPBOT/ 301/C-1C	Genetics and Plant Breeding (Theory and Practical)	6 (T 4+P 2)	10	40 (T 25+P 15)	50	4	N.A.	4
/302/C-2C	From another Discipline - 2	6	10	40	50			
/ 303/ C-3C	D From another Discipline - 3	6	10	40	50			
SPBOT /304/ SEC-1	Options from Botany:- Bio-fertilizer / Herbal Technology	2	10	40	50	2	N.A.	N.A.
Total in Semester - III		20	40	160	200			

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER – IV

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SPBOT /401/C-1D	Plant Physiology and Metabolism (Theory and Practical)	6 (T 4+P 2)	10	40 (T 25+P 15)	50	4	N.A.	4
/ 402/ C-2D	From another discipline-2	6	10	40	50			
/403/ C-3D	From another Discipline-3	6	10	40	50			
SPBOT 404/ SEC-2	Options from Botany:- Nursery & Gardening / Floriculture	2	10	40	50	2	N.A.	N.A.
Total in Semester - IV		20	40	160	200			

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

**SEMESTER – V**

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SPBOT /501/DSE-1A	Any one from:- Cell & Molecular Biology / Plant Anatomy and Embryology	6 (T 4+P 2)	10	40 (T 25+P 15)	50	4	N.A.	4
/ 502/DSE-2A	From another Discipline - 2	6	10	40	50			
/ 503/DSE-3A	From another Discipline - 3	6	10	40	50			
SPBOT /504/SEC-3	Options from Botany:- Medicinal Botany / Ethnobotany	2	10	40	50	2	N.A	N.A
Total in Semester – V		20	40	160	200			

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER – VI

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SPBOT /601/DSE-1B	Any one from:- Horticultural Practices and Post Harvest Technology/ Economic Botany & Biotechnology	6 (T 4+P 2)	10	40 (T 25+P 15)	50	4	N.A.	4
/ 602/DSE-2B	From another Discipline - 2	6	10	40	50			
/ 603/DSE-3B	From another Discipline - 3	6	10	40	50			
SPBOT /604/SEC-4	Options from Botany:- Plant Diversity & Human Welfare / Mushroom Culture Technology	2	10	40	50	2	N.A	N.A
Total in Semester – VI		20	40	160	200			

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

[SPBOT=Science Programme Botany, ACSHP=Arts Commerce Science Honours Programme,C= Core Course, H/MIL/E= Hindi/ Modern Indian Language/ English, AECC-E= Ability Enhancement Compulsory Course-English, AECC-ENV= Ability Enhancement Compulsory Course-Environmental Science, SEC= Skill Enhancement Course, GE= Generic Elective, DSE= Discipline Specific Elective IA= Internal Assessment, ESE= End-Semester Examination, Lec.= Lecture, Tu.= Tutorial, and Pr.=Practical]



1.3 Choices for Discipline Specific Electives

1) Cell & Molecular Biology	3) Economic Botany & Biotechnology
2) Plant Anatomy and Embryology	4) Horticultural Practices and Post Harvest Technology

1.4 Choices of Skill Enhancement Courses

1) Biofertilizers	3) Floriculture	7) Ethnobotany
2) Herbal Technology	4) Medicinal Botany	8) Mushroom Culture Technology
3) Nursery & Gardening	5) Plant Diversity & Human Welfare	



2. Core Courses

SEMESTER - I

2.1 CC-1A T1: Plant Biodiversity [Microbes, Algae, Fungi, Archegoniate (Bryophyta, Pteridophyta, Gymnosperm)]

(Theory: Lecture 60/Credits 4/Marks 25)

Unit 1: Microbes (10 lectures, Marks-4)

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2: Algae (12 lectures, Marks-4)

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia*. Economic importance of algae.

Unit 3: Fungi (12 lectures, Marks-5)

Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

Unit 4: Introduction to Archegoniate (2 lectures)

Unifying features of archegoniates, Transition to land habit, Alternation of generations.

Unit 5: Bryophytes (10 lectures, Marks-4)

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

Unit 6: Pteridophytes (8 lectures, Marks-4)

General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stellar evolution. Ecological and economical importance of Pteridophytes.

Unit 4: Gymnosperms (6 lectures, Marks-4)

General characteristics; Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus* (Developmental details not to be included). Ecological and economical importance.

2.2 CC-1A P1: Plant Biodiversity [Microbes, Algae, Fungi, Archegoniate (Bryophyta, Pteridophyta, Gymnosperm)]

(Practical: Marks 15/ Credits2)

List of Practical

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining & simple staining process
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Oscillatoria*, through temporary preparations and *Fucus* & *Polysiphonia* - Specimen and permanent slides
5. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual Structures through permanent slides.
6. *Alternaria*: Specimens/photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected *Justicia* leaves; section/tease mounts of spores on *Justicia* leaf and permanent slides of different spore forms.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: Ecto mycorrhiza and endo mycorrhiza (Photographs)
11. *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).
12. *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
13. *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (from permanent slide).
14. *Pteris*- 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).
15. *Cycas*- morphology (coralloid roots, bulbil, leaf), t.s. rachis, v.s. leaflet, (temporary slides), l.s. of ovule (permanent slide).
16. *Pinus*- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), t.s. of needle, t.s. stem (temporary slides), l.s./t.s. male cone, w.m. microspores , l.s. female cone, t.l.s. & r.l.s. stem (from permanent slide).

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.



SEMESTER - II

2.3 CC-1B T2: Plant Ecology, Morphology & Taxonomy

(Theory: Lecture 60/Credits 4/Marks 25)

Plant Ecology (30 Lectures, Marks-10)

Unit 1: Introduction (2 lectures)

Unit 2: Ecological factors (10 lectures)

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes

Unit 3: Plant communities (6 lectures)

Characters; Ecotone and edge effect; Succession; Processes and types

Unit 4: Ecosystem (8 lectures)

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

Unit 5: Phytogeography (4 lectures)

Principle biogeographical zones; Endemism

Taxonomy (30 Lectures, Marks-15)

Unit 6 Morphology (4 Lectures)

Leaves- Types , Phyllotaxy; Inflorescence – Definition and types; Flower – Different parts; Fruits - Definition and types

Unit 7 Introduction to plant taxonomy (2 lectures)

Identification, Classification, Nomenclature.

Unit 8 Identification (4 lectures)

Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

Unit 9: (5 lectures)

Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.

Unit 10 Taxonomic hierarchy (2 lectures)

Ranks, categories and taxonomic groups

Unit 11 Botanical nomenclature (5 lectures)

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Unit 12 Classification (4 lectures)

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Unit 13 (4 Lectures)

General characters and economic importance of the following families (range of floral structure excluded): Magnoliaceae, Brassicaceae, Malvaceae, Euphorbiaceae, Fabaceae, Apocynaceae, Lamiaceae, Solanaceae, Rubiaceae, Asteraceae, Poaceae, Orchidaceae

2.4 CC-1B P2: Plant Ecology & Taxonomy

(Practical: Marks 15/Credits 2)

Plant Ecology (Marks-6)

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
4. Ecological adaptations of some species: *Ipomoea aquatica* stem, *Nerium* leaf and *Vanda* root.
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.

Taxonomy (Marks-9)

7. Study of vegetative and floral characters of the following families (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, Asteraceae, Solanaceae, Lamiaceae, Malvaceae, Rubiaceae, Fabaceae, Apocynaceae, Acanthaceae, Verbenaceae.
8. Field visit (local) – Excursion/Field trips are to be organized in Botanically rich areas. A field report with photographic document of plants (atleast 10) and corresponding field record to be submitted during practical examination
9. Mounting of a properly dried and pressed specimen of any one wild plant with herbarium label (to be submitted in the record book).

Suggested Readings

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.



SEMESTER - III

2.5 CC-1C T3 - Genetics and Plant Breeding

(Theory :- Lectures: 60 / Credits 4/ Marks 25)

Unit 1: Heredity (20 Lectures)

1. Brief life history of Mendel
2. Terminologies
3. Laws of Inheritance
4. Modified Mendelian Ratios: 1:2:1- Co-dominance, incomplete dominance; 9:7; 12:3:1.
5. Chi Square
6. Multiple allelism
7. Chromosome theory of Inheritance.

Unit 2: Sex-determination and Sex-linked Inheritance

(4 Lectures)

Unit 3: Linkage and Crossing over (8 Lectures)

Linkage: concept & history, complete & incomplete linkage, bridges experiment, coupling & repulsion, recombination frequency, linkage maps based on two and three factor crosses. Crossing over: concept and significance, cytological proof of crossing over.

Unit 4: Mutations and Chromosomal Aberrations (6 Lectures)

Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy ; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations.

Unit 5: Plant Breeding (4 lectures)

Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.

Unit 6: Methods of crop improvement (10 lectures)

Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

Unit 7: Inbreeding depression and heterosis (4 lectures)

History, genetic basis of inbreeding depression and heterosis; Applications.

Unit 8: Crop improvement and breeding (4 lectures)

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.



2.6 CC-1C P3 Genetics and Plant Breeding

(Practical :- Credits 2 / Marks 15)

List of Practical

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Incomplete dominance and gene interaction through seed ratios (9:7, 12:3:1,).
3. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.
4. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
5. Hybridization techniques - Emasculation, Bagging (For demonstration only).
6. Induction of polyploidy conditions in plants (For demonstration only).

Suggested Readings

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley- India.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, 5th edition, John Wiley & Sons Inc., India,
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

SEMESTER - IV

2.7 CC-1D T4: Plant Physiology & Metabolism

(Theory: Lecture 60 /Credits 4/Marks 25)

Unit 1: Plant-water relations (8 lectures)

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Unit 2: Mineral nutrition (8 lectures)

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Unit 3: Translocation in phloem. (6 lectures)

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading

Unit 4: Photosynthesis (12 lectures)

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

Unit 5: Respiration (6 lectures)

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit 6: Enzymes (4 lectures)

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Unit 7: Nitrogen metabolism (4 lectures)

Biological nitrogen fixation; Nitrate and ammonia assimilation.

Unit 8: Plant growth regulators (6 lectures)

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Unit 9: Plant response to light and temperature (6 lectures)

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

2.8 CC-1D P4: Plant Physiology & Metabolism

(Practical: Marks 15/Credits 2)

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and humidity) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. To study the effect of light intensity and bicarbonate concentration on O₂ evolution in photosynthesis.
6. Comparison of the rate of respiration in any two parts of a plant.

Demonstration experiments (any four)

1. Bolting. 2. Effect of auxins on rooting.
3. Suction due to transpiration. 4. R.Q.
5. Respiration in roots.

Suggested Readings

3. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
1. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
2. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.



3. Discipline Specific Elective Courses

3.1 DSE T1 Cell and Molecular Biology

(Theory :- Lectures: 60 / Credits 4/ Marks 25)

Unit 1: Techniques in Biology (8 Lectures)

Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

Unit 2: Cell as a unit of Life (2 Lectures)

The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.

Unit 3: Cell Organelles (20 Lectures)

Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA.

Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. ER, Golgi body & Lysosomes: Structures and roles. Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants and biogenesis. Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

Unit 4: Cell Membrane and Cell Wall (6 Lectures)

The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall.

Unit 5: Cell Cycle (6 Lectures)

Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.

Unit 6: Genetic material (6 Lectures)

DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi-conservative, semi discontinuous RNA priming, (theta) mode of replication, replication of linear, ds- DNA, replicating the 5 end of linear chromosome including replication enzymes.

Unit 7: Transcription (Prokaryotes and Eukaryotes) (6 Lectures)

Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.

Unit 8: Regulation of gene expression (6 Lectures)

Prokaryotes: Lac operon and Tryptophan operon ; and in Eukaryotes.

3.2 DSE P1 Cell and Molecular Biology

(Practical :- Credits 2 / Marks 15)

List of Practical

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. Demonstration of dialysis of starch and simple sugar.
7. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
8. Measure the cell size (either length or breadth/diameter) by micrometry.
9. Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
10. Study DNA packaging by micrographs.
11. 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.

3.3 DSE T2: Plant Anatomy & Embryology

(Theory: Lecture 60 /Credits 4/Marks 25)

Plant Anatomy

Unit 1: Meristematic and permanent tissues (8 lectures)

Root and shoot apical meristems; Simple and complex tissues, Tissue Systems.

Unit 2: Organs (4 lectures)

Structure of dicot and monocot root stem and leaf.

Unit 3: Secondary Growth (8 lectures)

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood)

Unit 4: Adaptive and protective systems (8 lectures)

Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Embryology

Unit 5: Structural organization of flower (8 lectures)

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Unit 6: Pollination and fertilization (8 lectures)

Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit 7: Embryo and endosperm (8 lectures)

Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship

Unit 8: Apomixis and polyembryony (8 lectures)

Definition, types and Practical applications

3.4 DSE P2: Plant Anatomy & Embryology

(Practical: Marks 15/Credits 2)

List of Practical

Plant Anatomy

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).

Embryology

7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ Campylotropous (from permanent slide).
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Pollen morphology: Impatiens, Hibiscus (from permanent slide)
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. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

3.5 DSE T3: Economic Botany and Biotechnology

(Theory :- Lectures: 60 / Credits 4/ Marks 25)

Unit 1: Origin of Cultivated Plants (4 Lectures)

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

Unit 2: Cereals (4 Lectures)

Wheat -Origin, morphology, uses

Unit 3: Legumes (6 Lectures)

General account with special reference to Gram and soybean

Unit 4: Spices (6 Lectures)

General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)

Unit 5: Beverages (4 Lectures)

Tea (morphology, processing, uses)

Unit 6: Oils and Fats (4 Lectures)

General description with special reference to groundnut

Unit 7: Fibre Yielding Plants (4 Lectures)

General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 8: Introduction to biotechnology (2 lecture)

Unit 9: Plant tissue culture (8 Lectures)

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

Unit 10: Recombinant DNA Techniques (18 Lectures)

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.

3.6 DSE P3: Economic Botany and Biotechnology

(Practical :- Credits 2 / Marks 15)

List of Practical

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

3.7 DSE T4: Horticultural practices & Post Harvest Technology

(Theory: Lecture 60 /Credits 6/Marks 40)

Unit 1: Introduction (4 lectures)

Scope of Horticulture, Branches of horticulture; Role in economy, Scope of employment generation; Importance in food and nutritional security; Commercial Horticulture: Urban horticulture and ecotourism.

Unit 2: Ornamental plants (4 lectures)

Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental annuals - marigold, carnations, poppies, Petunias, Pansies, Impatiens, Identification and salient features of some ornamental perennials - Rose, Gladiolus, Orchids, Gerberas, Tuberose, Chrysanthemum, Cacti and Succulents (Opuntia, Agave and Spurges), Croton. Identification and salient features of some ornamental flowering climbers – Ipomoeas, Quisqualis indica, Pyrostegia venusta, Aganosma caryophyllata, Bignonias.

Identification and salient features of some ornamental flowering trees - Indian Laburnum (*Cassia fistula*), Gulmohar (*Delonix regia*), Jacaranda, Lagerstroemia, Fishtail (*Caryota urens*) and areca palms, Semul (*Bombax ceiba*), Coraltree (*Erythrina variegata*), Palash (*Butea monosperma*).

Unit 3: Fruit and vegetable crops (4 lectures)

Production, origin and distribution of major fruits – Apple, Banana, Orange, Lemon, Grapes, Mango, Watermelon, Litchi, Pomegranate, Pineapple, Guava, Papaya; Production, origin and distribution of major vegetables – Crucifers, Potato, Chillies, Carrot, Radish, Peas, Gourds, Cucumber, Lady's finger, Onion, Tomato, Pumpkin, Beans, Brinjal, Spinach. Description of plants and their economic products of the above mentioned fruits and vegetables. Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, Oranges, Chillies, Crucifers, Beans and Cucurbits).

Unit 4: Horticultural techniques (8 lectures)

Application of manure, fertilizers, nutrients and PGRs; Weed control; Biofertilizers, biopesticides; Irrigation methods (drip irrigation, surface irrigation, furrow and border irrigation); Hydroponics; Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Scope and limitations.

Unit 5: Landscaping and garden design (6 lectures)

Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Urban forestry; policies and practices.

Unit 6: Floriculture (6 lectures)

Cut flowers, bonsai, commerce (market demand and supply); Importance of flower shows and exhibitions.

Unit 7: Post-harvest technology (10 lectures)

Importance of post harvest technology in horticultural crops; Evaluation of quality traits; Harvesting and handling of fruits, vegetables and cut flowers; Principles, methods of preservation and processing; Methods of minimizing losses during storage and transportation; Food irradiation - advantages and disadvantages; food safety.

Unit 8: Disease control and management (8 lectures)

Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.

Unit 9: Horticultural crops - conservation and management (10 lectures)

Documentation and conservation of germplasm; Role of micropropagation and tissue culture techniques; Varieties and cultivars of various horticultural crops; IPR issues; National,



international and professional societies and sources of information on horticulture.

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Unit 10: Field trip

Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at IARI or other suitable locations.

Suggested Readings

1. Singh, D. & Manivannan, S. (2009). Genetic Resources of Horticultural Crops. RidhiInternational, Delhi, India.
2. Swaminathan, M.S. and Kochhar, S.L. (2007). Groves of Beauty and Plenty: An Atlas of Major Flowering Trees in India. Macmillan Publishers, India.
3. NIIR Board (2005). Cultivation of Fruits, Vegetables and Floriculture. National Institute of Industrial Research Board, Delhi.
4. Kader, A.A. (2002). Post-Harvest Technology of Horticultural Crops. UCANR Publications, USA.
5. Capon, B. (2010). Botany for Gardeners. 3rd Edition. Timber Press, Portland, Oregon.



4. Skill Enhancement Courses

4.1 SEC T1 Biofertilizers

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (4 Lectures)

General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

Unit 2: (8 Lectures)

Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Unit 3: (4 Lectures)

Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Unit 4: (8 Lectures)

Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit 5: (6 Lectures)

Organic farming Green manuring and organic fertilizers, Recycling of bio- degradable municipal, agricultural and Industrial wastes biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad



4.2 SEC T2 Herbal Technology

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (6 Lectures)

Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

Unit 2: (6 Lectures)

Pharmacognosy - systematic position and medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

Unit 3: (6 Lectures)

Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

Unit 4: (8 Lectures)

Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

Unit 5: (4 Lectures)

Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy)

Suggested Readings

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International BookDistributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.



4.3 SEC T3 Nursery and Gardening

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (4 Lectures)

Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.

Unit 2: (6 Lectures)

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.

Unit 3: (6 Lectures)

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house.

Unit 4: (8 Lectures)

Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

Unit 5: (6 Lectures)

Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

Suggested Readings

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

4.4 SECTION 4 Floriculture

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (2 Lectures)

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.

Unit 2: (8 Lectures)

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.

Unit 3: (4 Lectures)

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.

Unit 4: (4 Lectures)

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.

Unit 5: (4 Lectures)

Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

Unit 6: (6 Lectures)

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, Liliium, Orchids).

Unit 7: (2 Lectures)

Diseases and Pests of Ornamental Plants.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

4.5 SECTION 5 Medicinal Botany

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (10 Lectures)

History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit 2: (10 Lectures)

Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit 3: (10 Lectures)

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

Suggested Readings

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

4.6 SEC T6 Plant Diversity and Human Welfare

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (8 Lectures)

Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

Unit 2: Loss of Biodiversity: (8 Lectures)

Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss,

Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

Unit 3: Conservation of Biodiversity: (8 Lectures)

Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

Unit 4: Role of plants in relation to Human Welfare: (6 Lectures)

a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi



4.7 SECTION 7 Ethnobotany

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: Ethnobotany (6 Lectures)

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

Unit 2: Methodology of Ethnobotanical studies (6 Lectures)

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

Unit 3: Role of ethnobotany in modern Medicine (10 Lectures)

Medico-ethnobotanical sources in India; Significance of the following plants in ethnobotanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*.

Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).

Unit 4: Ethnobotany and legal aspects (8 Lectures)

Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

Suggested Readings

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981
3. Lone et al., Palaeoethnobotany
4. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
5. S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
6. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
7. Rama Rao, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah. 8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996 9)

4.8 SEC T8 Mushroom Culture Technology

(Theory:- Credits 2 / Lectures: 30 / Marks 40)

Unit 1: (5 Lectures)

Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

Unit 2: (12 Lectures)

Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

Unit 3: (8 Lectures)

Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit 4: (5 Lectures)

Food Preparation : Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.