INSTITUTE OF SCIENCE, NAGPUR.

(An Autonomous Institute of Government of Maharashtra)

DIRECTION NO. 1 OF 2023

DIRECTION RELATING TO THE NORMS FOR RESTRUCTURING THE TEACHING AND EXAMINATION SCHEME OF B.SC. SEMESTER III, IV, V, AND VI AS PER NEP-2020

IN THE INSTITUTE OF SCIENCE, NAGPUR

Teaching and Examination Scheme

Bachelor of Science (B.Sc.)

Three-Year (Six Semester Degree Course)

B.Sc. Semester III

Sr. No.	Subject	Subject Code	Teaching Scheme				Scheme of Examination							Total Credit
			TH	Activity	TU	Practical	Duration	Max TH Marks	Max IA Marks	Max Practical Marks	Total Marks	Min TH Marks	Min Practical Marks	
(For the Subject with Tutorial)														
3	ANGIOSPERM SYSTEMATIC, EMBRYOLOGY AND INDOOR GARDENING	BBSS31	2	1	--	3	3	50	10	30	150	48	15	3.2
4	ANGIOSPERM ANATOMY AND HORTICULTURE	BBSS32	2	1	1	3	3	50	10					3.6

Teaching and Examination Scheme

Bachelor of Science (B.Sc.)

Three-Year (Six Semester Degree Course)

B.Sc. Semester IV

Sr. No.	Subject	Subject Code	Teaching Scheme				Scheme of Examination							Total Credit
			TH	Activity	TU	Practical	Duration (Hrs)	Max TH Marks	Max IA Marks	Max Practical Marks	Total Marks	Min TH Marks	Min Practical Marks	
(For the Subject with Tutorial)														

3	CELL BIOLOGY, PLANT BREEDING, EVOLUTION AND SEED TECHNOLOGY	BBSS41	2	1	--	3	3	50	10	30	150	48	15	3.2
4	GENETICS, MOLECULAR BIOLOGY AND PLANT NURSERY	BBSS42	2	1	1	3	3	50	10					3.6

Teaching and Examination Scheme

Bachelor of Science (B.Sc.)

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B.Sc. Semester V

Sr. No.	Subject	Subject Code	Teaching Scheme				Scheme of Examination							Total Credit
			TH	Activity	TU	Practical	Duration	Max TH Marks	Max IA Marks	Max Practical Marks	Total Marks	Min TH Marks	Min Practical Marks	
(For the Subject with Tutorial)														
3	PLANT PHYSIOLOGY, MINERAL NUTRITION AND HYDROPONICS	BBTS51	2	1	--	3	3	50	10	30	150	48	15	3.2
4	PLANT ECOLOGY AND ORGANIC FARMING	BBTS52	2	1	1	3	3	50	10					3.6

Teaching and Examination Scheme

Bachelor of Science (B.Sc.)

Three-Year (Six Semester Degree Course)

B.Sc. Semester VI

Sr. No.	Subject	Subject Code	Teaching Scheme				Scheme of Examination							Total Credit
			TH	Activity	TU	Practical	Duration	Max TH Marks	Max IA Marks	Max Practical Marks	Total Marks	Min TH Marks	Min Practical Marks	
(For the Subject with Tutorial)														
3	BIOCHEMISTRY, BIOTECHNOLOGY AND HERBAL TECHNOLOGY	BBTS61	2	1	--	3	3	50	10	30	150	48	15	3.2
4	PHYTOGEOGRAPHY, UTILIZATION OF PLANTS, TECHNIQUES AND PHARMACOGNOSY	BBTS62	2	1	1	3	3	50	10					3.6

T**abel-1: Conversion of marks to grades and Grade point Average**

Marks obtained out of **100** marks	Marks obtained out of **150** marks	Marks obtained out of **75** marks	**Grade point**	**Letter Grade**
91 – 100	136 – 150	68 – 75	**10**	**O**
81 – 90	121 – 135	61 – 67	**9**	**A+**
71 – 80	106 – 120	53 – 60	**8**	**A**
61 – 70	91 – 105	46 – 52	**7**	**B+**
51 – 60	76 – 90	38 – 45	**6**	**B**
41 – 50	61 – 75	31 – 37	**5**	**C**
40	60	30	**4**	**P**
< 40	< 60	< 30	**0**	**F**
AB	AB	AB	**0**	**Ab**

T**abel-2: Credit Conversion**

Sr. No.	Head	No. of Lectures	Duration (in Minutes)	Credit
1	Theory	01	48	**0.8**
		02	96	**1.6**
		03	144	**2.4**
		04	192	**3.2**
		05	240	**4.0**
		06	288	**4.8**
2	Practical	01	48	**0.4**
		02	96	**0.8**
		03	144	**1.2**
		04	192	**1.6**
		05	240	**2.0**
		06	288	**2.4**
3	Tutorial	01	48	**0.8**

SEMESTER-III

Paper I

(ANGIOSPERM SYSTEMATIC, EMBRYOLOGY AND INDOOR GARDENING)

Objective:

- To create the interest regarding plant systematic and angiosperms.
- To create interest among learners regarding basics of plant embryology and gardening

Outcome:

1. Students will learn about origin of angiosperms, their present status and modern trends.
2. Students will learn about various plant classification systems
3. Students will be able to know regarding various embryological features and details of reproductive structures of flower.
4. Student will learn about basic skills of landscaping and gardening.

Unit-1: Systematic Botany:

1. Origin of Angiosperms (Benettitalean theory)
2. Fossil angiosperms: Flowers (*Sahanianthus*); Fruit: (*Enigmocarpon*)
3. Angiosperm Taxonomy: Floras, Herbarium, Keys (Intended and Bracketed)
4. Botanical nomenclature: Principles (Rank of taxon, Principles of priority)
5. Modern trends in Taxonomy: Cytotaxonomy (Karyotype), Phytochemistry (Proteins and Flavenoids)

Unit-2: Angiosperm: Classification and Families:

1. Systems of Classification: Bentham and Hooker; Engler and Prantl (Along withMerits and Demerits)
2. Study of families: Dicot: Malvaceae, Brassicaceae, Papilionoidae, Asteraceae, Asclepiadaceae. Monocot: Poaceae

Unit-3: Embryology:

1. Pollination: Types and significance
2. Anther: T. S. of anther, Microsporogenesis; Structure of pollen grain , Development of malegametophyte.
3. Ovule:Types of ovule, Structure of a anatropus ovule, Megasporogenesis, Development of female gametophyte (Polygonum type)
4. Fertilization: Double fertilization and triplefusion, Endosperm and its types, Structure of Dicot embryo (Onagrad) and monocot embryo

Unit-4: Skill Development: Landscaping and Indoor gardening

1. Landscaping-Definition, scope of landscaping(Landscaping at office, Industrial premices, Educational institutes, Parks)
2. Indoor gardening: Brief account of places of house plants, pots and containers, factorrequired for growing house plants (Temperature, light, humidity, ventilation, watering, Soil, Feeding, Potting)
3. Popular house plants: Foliage plants: *Coleus blumeri*, *Begonia* sp., Fern: *Adiantum* sp., *Nephrolepis*sp., Palms: *Chrysalidocarpuslutescens*, Areca palm, *Howeaforsteriana* – Kentia palm, Flowering plant: *Anthurium*sp., *Begonia* sp., Orchids: *Vanda* sp., *Dendrobium* sp.

List of Practicals:

1. Study of fossil angiosperms from Specimens / Slides.
2. Study of dicot and monocot families mentioned in theory syllabus.
3. To calculate percent germination of pollen grains in the given material
4. Study of structure of anther and pollen grain.
5. Study of different type of ovules
6. Study of dicot and monocot embryos from permanent micro-preperations.
7. Study of different popula house plants.

Paper II

(ANGIOSPERM ANATOMY AND HORTICULTURE)

Objective: To impart knowledge of internal structure of plant and its use in horticultureOutcome:

1. **Students will learn about different tissue system in Plants**
2. **Students will learn difference between Dicot and Monocot Anatomy**
3. **Students will be able to implement knowledge of anatomy in commercial horticultural crops**

Unit I: Anatomy

1. **Tissue:** Definition, Characteristics of Meristematic tissue; Classification of meristems **(**based on origin and position**).**
2. **Simple Permanent tissue and their functions**: Parenchyma, Collenchyma, and Sclerenchyma
3. **Complex Permanent Tissue and their function**: Xylem and Phloem.
4. **Apical meristem of Root and Shoot**: Apical cell theory, Histogen theory, Tunica-corpus theory, Newman's Theory.
5. **Cambium:** Structure, Types, functions.

Unit II: Primary and Secondary Growth in Stem and Root:

1. **Types of vascular bundles**: Radial, Conjoint, Concentric.
2. **Normal Primary structure of root**: Dicot (*Sunflower*) and Monocot (*Maize*)
3. **Normal Primary structure of stem**: Dicot (*Sunflowe*r) and Monocot (*Maize)*
4. **Normal Secondary growth in dicot stem**: *Sunflower*
5. **Anomalous Secondary growth in**: Dicot stem (*Bignonia)* and Monocot stem (*Dracaena)* .

Unit III: **Periderm, growth ring, Sap - heart wood, Leaf anatomy**

1. **Growth rings:** Spring wood and Winter wood
2. Sap wood, Heart wood, Tyloses
3. **Periderm**: Composition, functions and Structures associated with periderm(Lenticel, Bark, Commercial cork)
4. **Anatomy of leaf**: Dicot (*Nerium*) and Monocot (Maize)
5. Senescence and Abscission

Unit IV: **Skill Development: Horticulture**

1. **Horticulture:** Definition and Scope, importance of horticulture, water requirement and irrigation, nutrient management
2. Methods of propagation of following horticultural crops; (Propagation by seeds, Vegetative propagation, Propagation through specialised organ) : *Rose, Chrysanthemum, Crotons, mangoes, Citrus, Guava, Lilium.*
3. Technique of Bonsai preparation

List of Practical

1. Study of simple and complex tissue from permanent micro-preparation.
2. Study of different types of vascular bundles.
3. Study of internal structure of dicot and monocot root with the help of temporarymicro-preparation.
4. Anatomy of Dicot and Monocot stem with the help of temporary or double stained permanent micro-preparation.
5. Anatomy of normal and anomalous secondary growth in stem with the help of double stained permanent micro-preparation.
6. Study of internal structure of dicot (*Nerium*) and Monocot leaf (Maize) with the help of temporary micro-preparation.
7. Study of various horticultural crops mentioned in syllabus.

Botany Practical

ExaminationB.Sc. Semester

III

TIME: FIVE HOURS **MAX. MARKS: 30**

Q 1. Describe in technical language the given **Angiospermic** material**(A)**. Classify andidentify the family giving reasons. 05 M

Q 2. Calculate percent germination of **pollen grains** in given material**(B).** 03 M

Q 3. Prepare temporary mount of the given **root/leaf** material **(C)** and identify giving diagnostic characters. 04 M

Q 4. Prepare double stained permanent mount of the given **stem** material **(D).** Identify givingdiagnostic characters. 05M

Q 5. **Spotting**: 05 M

(E) Fossil Angiosperms

(F) Embrology

(G) Tissue

(H) Popular House plant

(I) Horticultural plant

Q 6. Viva-Voce 03 M

Q 7: Practical Record and Excursion Report. 05 M

Suggested Readings: Semester III

Agarwal PKR and Bhargava P (2017): Home Gardening PustakMahal AllahabadIndia.

Barker (1954): Aperture membranes in studies of pollen morphology and taxonomym,New phytologist50438

Bhojwani SS and Bhatnagar S P (2010): embryology of angiosperms Vikaspublishing house Delhi

Chaddake (2001): handbook of horticulture Indian council of agricultural researchNew Delhi India

Cutter E. G. (1971): plant anatomy experiment and interpretation part 2 organsEdward Arnold London.

Davies P. H. and HeywoodV. H.(1973) Principles of angiosperms taxonomy RobertE.Kreiger Pub co New York.

Dutta S. C.(1989):Systematic botany, Wiley eastern Co.

Erdtman G.(1966): Pollen morphology and plant taxonomy of angiosperms,HafnerNew York.

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Erdtman G.(1952): Pollen morphology and plant Taxonomy (An Introduction toPalynology)
Erdtman G.(1957): Pollen and spore morphology and plant taxonomy (Anintroduction to palynology) Hafner New York.

Esau, K. (1979): Anatomy of seed plants (3rd edition) John wiley and sons New York,Fahn, A. Plant anatomy 2nd edition PregamonPress Oxford.

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Heslop Harrison J(1971): Editor Poland development and physiology butterworths London.

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Khalid H and Nawaz K.(2014):Introductory plant taxonomy Kalyani publicationsNew Delhi.

NaikV. N. Taxonomy of angiosperms

Nair PKK (1970) Pollen morphology of angiosperms scholar publications houseLucknow.

Proctor M and Yeo P. (1973): The pollination of flowers William Collins sonsLondon.

Radford A. E.: (1986) Fundamentals of plant systematic, Harper and row New York.

Raghavan V. (1986): Embryogenesis in angiosperms a developmental and experimental study Cambridge University press Cambridge.

Royal horticultural societies in encyclopaedia of gardening Singh R (2012)horticulture at a glanceKalyani publication Navi Delhi.

Singh H(1978): Embryology of Gymnosperms, encyclopaedia of plant anatomy x debrider Bortragear Berlin.

Singh J.(2014): Basic Horticulture Kalyani publications Lucknow India.

Ugemuge N R. (1986): Flora of Nagpur district ShriPrakashan Nagpur.

VeenaAmarnathNursery and landscape agrobios India.

Vishnu SwaroopIndoor gardening (1993): Publication and information division ICARNew Delhi – 12.

SEMESTER IV

PAPER – I

CELL BIOLOGY, PLANT BREEDING, EVOLUTION AND SEED TECHNOLOGY.

Objectives:

1. Understanding the structures and functions of the cell wall, plasma membrane and plasmodesmata
2. Understanding the structures and functions of cell organelles, cytoskeleton, nuclear envelope, and cell division
3. Evaluate the biostatistical methods.

Outcomes:

After successful completion of the course the students will be able to

1. Describe the structure of plant cell and its organelles.
2. Analyze the morphology of chromosome organization.
3. Understand the plant cell-division and its significance
4. Understand the biostatic formulas.
5. Understand the method of plants breeding, Objectives and application of plant breeding.
6. Understand about different types of seeds used by farmers and about methods of seed testing.

Unit I

Cell: Brief account of cell theory, comparison between prokaryotic and eukaryotic cellorganization, Structure of typical plant cell.

Structure and functions of: Cell wall, Cell Membrane (Fluid mosaic model), Nucleus, Endoplasmic reticulum (RER and SER), Golgi Complex, Vacuoles, Ribosomes (70S and80S)

Unit II

Ultrastructure & Functions of: Mitochondria, Chloroplasts and Nucleus.

Chromosome organization: Morphology (chromatid, chromomere, centromere, telomere,secondary constriction, satellite, karyotype)

Molecular organization: Nucleosome model

Sex Chromosome: Structure of sex chromosome in plants (XY type in *Melandrium*)

Cell division in plants: Mitosis, Meiosis and their significance.

Unit III

Plant Breeding- Definition and objective

Methods of plant breeding: Pure line selection, Hybridization (emasculation, bagging, crossing, labeling), Clonal selection, Heterosis (Definition and scope)

Biostatistics- Mean, Mode, Median, Standard deviation, Standard error, Student's t- test

Evolution- Origin of life (Millers theory)

Unit IV

Seed: Structure and Types.

Seed dormancy: Causes, methods of breaking dormancy.

Seed Technology: Seed Storage, seed banks, factors affecting seed viability, genetic erosion,and methods of seed production, seed testing and certification.

Commercial types of seeds: Farmers seeds, foundation seeds, breeders seeds and certified seeds.

List of Practical's:

1. Study of Cell organelles with the help of photographs/ Slides
2. Study of mitosis in plant material
3. Study of meiosis in plant material
4. To calculate Mean, Mode, Median, standard error from the given data (At least 10 problems to be solved)
5. To calculate the student's t-value from the given data (At least 10 problems to be solved)
6. To study seed viability and percentage seed germination by TTC.

PAPER – II

GENETICS, MOLECULAR BIOLOGY AND PLANT NURSERY

Objectives:

1. Understand the laws of inheritance, various modifications, types of chromosomal inheritance patterns
2. Understand multiple alleles and multiple gene inheritance, linkage and crossing over.
3. Learn structural and numerical changes in chromosomes, mutations and inheritance patterns in various biological organisms and in their populations.

Outcomes:

After successful completion of the course the students will be able to

1. Know the Mendelism and laws of Mendel.
2. Summarize the theories of linkage.
3. Design and construct the variation in chromosome structure and number.
4. Understand the concept of gene
5. Know the types of mutations and its application in crop–improvement.
6. Understand structure of nursery and its management

Unit- I

Mendelism: - Monohybrid cross, Law of segregation, Dihybrid cross, Law of independentassortment, Back cross and Test cross.

Interaction of genes: Allelic- Incomplete dominance (1:2:1 ratio in *Mirabilis jalapa*); Nonallelic- Complementary (9:7 ratio) and Dominant epistasis (12:3:1 ratio)

Linkage: Definition, Theory of linkage (Coupling and Repulsion theory), types (completeand incomplete), significance.

Crossing over: Definition, theories (Breakage and reunion), significance

Unit- II

Mutation: Definition, Types: Spontaneous and induced mutations, physical and chemicalmutagens, application of induced mutations.

Chromosomal aberrations: Deficiency, duplications, inversion and translocation.

Variation in chromosome number: Polyploidy (autopolyploidy and allopolyploidy), aneuploidy (nullisomics, monosomics, trisomics and tetrasomics), significance.

DNA damage and repair: Photoreactivation, excision repair

Unit- III

DNA: Structure of DNA (Watson and Crick model)

Replication: Semi conservative method of DNA replication in eukaryotes.

RNA: Types, t-RNA (Clover leaf model).

Genetic code: Definition and characteristics

Protein synthesis: Transcription and translation

Regulation of gene expression: Lac operon model.

Unit- IV

Nursery: Definition and role or objective, nursery infrastructure.

Planning and seasonal activities : Preparation of nursery beds, planting direct seedling andtransplant, air layering, budding, grafting, cutting, rooting medium, hardening of plant.

Nursery management : Routine garden operations, soil sterilization, seed sowing, pricking,shading, stopping or pinching, defoliation, wintering, mulching and topiary.

List of practical's

1. To prove the Mendel's law of segregation with the help of coloured beads.
2. To prove the Mendel's law of independent assortment with the help of coloured beads.
3. From the given data workout, the type of gene interaction in the given cross (At least 10)
4. Problems of each type mentioned in theory syllabus)
5. To study different methods of vegetative propagation (air layering, budding, grafting, cutting)
6. To study methods of sterilization for plant nursery.

Note: Short Excursion Tour to Nursery Is Expected

Semester IV Practical examination

Question Paper

TIME: 5 HOURS **MAX.MARKS : 30**

1. Prepare semi-permanent squash / smear of given material [a] &identify the stage of cell division. 04 M
2. To solve the given problem of biostatistics from given data (B) 03 M
3. To determine seed viability of the given seeds(C) and report the findings. 03 M
4. To prove Mendel's Law of Inheritance through coloured beads [D] 04 M
5. To work out the type of gene interaction in the given cross from the given data. 04 M
6. Spotting : 04 M

   F Cell Organelle G Cell Division

   H Tooled used in nursery I Methods of vegetative propagation.

7. Viva-Voce 03 M
8. Practical record and excursion report. 05 M

Suggested Reading

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Singh, H. (1978), Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy X,Gebryder, Bortragear, Berlin

Snustad, D. P. and M. J. Simmons [2000]. Principles of Genetics (John Wiley andsons, USA)

Watson J. D.,Hopkins, Roberts ,Steitz, Weiner (1987) : Molecular Biology of Gene, (Benjamin-Cummings Pub.Co. Sherman)

SEMESTER -V

PAPER – I

PLANT PHYSIOLOGY, MINERAL NUTRITION AND HYDROPONICS

Objectives:

1. Understanding photosynthesis and respiration in plants.
2. Understanding mechanistic underpinnings of the plant hormones and sensory photobiology.
3. Understanding Nitrogen Metabolism.
4. Understanding the solute transport system and metabolism

Outcomes: After successful completion of the course the students will be able to

1. Understand concept of water potential & osmotic potential.
2. Summarize the cycle of respiration and photosynthesis.
3. Understand plant water relation. Write about mineral nutrients.
4. Learn the description and Classification of biomolecules.
5. Understand about respiration and Respiratory quotient.
6. Learn types and mechanism of fermentation.
7. Understand basic knowledge of hydroponic system.

Unit I

Plant-water relations: Properties of water, diffusion, diffusion pressure deficit and its significance; Osmosis: Concept, types, osmotic potential and its significance; Imbibition: concept and significance
Ascent of sap: Definition, Root pressure theory, cohesion-adhesion theory.
Transpiration: Definition, types, mechanism of stomatal movements (K+-malate hypothesis)
Phloem transport: Munch hypothesis

Unit II

Photosynthesis: Definition, significance, photosynthetic pigments and their role, photosystems.
Mechanism of Photosynthesis: Light Reaction: cyclic and non-cyclic photophosphorylation, Light independent reactions: C3, C4 and CAM pathways and their significance.
Respiration: Definition, Types (aerobic and anaerobic respiration), respiratory substrates and Respiration quotient.
Mechanism of respiration: Glycolysis, Krebs's cycle, oxidative phosphorylation (ETS).

Fermentation: Definition, types, mechanism :alcoholic and lactic acid.

Unit III

Nitrogen metabolism: Definition, Mechanism of biological nitrogen fixation (Symbiotic and non-symbiotic)
Plant movements: Definition, outline, Tropic (geotropic, phototropic, thigmotropic) andNastic-seismonastic.
Photoperiodism: Definition, classification (short day, long day & day neutral plants)
Photoperiodic induction, Florigen hormone.
Circadian rhythms and biological clock

Unit IV: Skill development: Hydroponics

Mineral nutrition: Definition, source and types (macro and micronutrients)
Role and deficiency symptoms of macronutrients: Nitrogen, phosphorus, potassium and calcium.
Role and deficiency symptoms of micronutrients: Iron, manganese, bronze and zinc.
Hydroponics: Definition, advantages and disadvantages, types (deep water and nutrient film technique), nutrient composition.
Methods: Hydroponic farming of tomato, cucumber, spinach and cabbage.

List practical's Major:

1. To study the effect of various organic solvents on permeability of membranes.
2. To determine osmotic potential of the cell sap by plasmolytic method.
3. To study the ascent of sap in suitable plant material.
4. To compare rate of transpiration from two surfaces of leaf by cobalt chloride and bell jar method.
5. To separate chlorophyll pigment by paper chromatography.
6. To determine the RQ of given plant material.
7. To study the effect of light intensity and quality, CO2 concentration and temperature on rate of photosynthesis by Willmott's bubbler.

Minor:

1. To demonstrate phenomenon of Imbibitions.
2. To demonstrate root pressure in suitable plant material.
3. To demonstrate light is necessary for photosynthesis (Ganong's light screen)
4. To demonstrate fermentation by Kuhne's tube.
5. To demonstrate phenomenon of nastic movement in *Mimosa pudica* plant.

PAPER – II

PLANT ECOLOGY AND ORGANIC FARMING

Objective: Define and explain about branches of Ecology and Ecosystem, organic farmingand its significance.

Course Outcomes: At the end of the course student will able to

1. Learn significance and branches of Ecology and Ecosystem.
2. Summarize the environmental factors.
3. Understand and the nitrogen and phosphorus cycle.
4. Know the various Phytogeographic regions of India.
5. Understand the effect of climatic factors on vegetation.
6. Understand methods of organic farming.

Unit I

Ecology: definition, branches and significance of ecology.

Climatic Factors: Atmospheric (Gaseous composition), Light & Temperature (effect on vegetation).

Edaphic Factors: Pedogenesis, Soil profile, Soil properties (physical and chemical). **Physiographic factor**: Biotic Factor: Interactions between plants and animals and human,Interaction between plants growing in a community

Unit II

Ecosystem: Biotic and Abiotic components, Food chain, Food web, Ecological pyramids **Autecology**: (definition, importance), ecads, ecotype- characteristics and importance **Synecology**: (or community ecology)- Study of community: analytical (quantitative- frequency, density, abundance; qualitative- Life forms, Raunkier's Biological spectrum) and synthetic characters (presence, fidelity, dominance).

Unit III

Plant succession: Definition, Causes of succession, Hydrosere, Xerosere

Plant adaptations: Morphological, Anatomical & Physiological responses of Hydrophytes (*Hydrilla*, *Nymphaea*), Xerophytes (*Casurina*, *Nerium*), Halophyte and Epiphyte (*Vanda*)

Biogeochemical Cycles: Phosphorus and Nitrogen.

UNIT IV: Skill development: Organic Farming

Organic Farming: Definition, concept, advantages and disadvantages, green manure andorganic fertilizers.

Methods: Recycling of biodegradable kitchen, agricultural and industrial waste.

Methods of: Preparation of biocompost, preparation of Vermi-compost and its type,isolation and inoculum production of VAM.

Organic Manure: Effect of organic manures on growth and yield productivity of variouscrop plants.

List of practicals:

1. To determine frequency, density, abundance of the community by quadrate method.
2. To determine the homogeneity of vegetation by Raunkier's frequency diagram.
3. To determine the minimum number of quadrates required for reliable estimate of biomass in grassland.
4. To determine the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkier's standard frequency diagram.
5. To measure the above ground plant biomass in a grassland.
6. To study soil profile at different locations of nearby area.
7. To estimate transparency, pH and temperature of different water bodies.
8. To estimate salinity (chlorides) of different water samples.
9. To study the morphological and anatomical characteristics of hydrophyte, xerophytes, halophytes and epiphyte with reference to ecological adaptations.
10. Collection and identification of various organic manures.
11. To study the methodology of preparation of vermicompost.

Note: Botanical Excursions (One short tour/visit to organic farm is compulsory).

Semester V Practical examination

Question Paper

Time : 5 hrs Marks : 30

Q. 1) To perform given major Physiology Experiment [A] & report the findings 05

Q. 2) To perform the minor Physiology Experiment [B] & report the findings 03

Q. 3) To perform the given Ecological Experiment [C] & report the findings 05

Q. 4) To study morphological and anatomical characteristics of the given plant material [D] with reference to ecological adaptations 05

Q. 5) Spotting: 04

E - Plant PhysiologyF G - Hydroponics

- Ecology H - Manures

Q. 6) Viva Voice 03

Q. 7) Practical Record & Excursion Report 05

Suggested Readings

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SEMESTER – VI

PAPER – I

BIOCHEMISTRY, BIOTECHNOLOGY AND HERBAL TECHNOLOGY.

Objectives:

1. Understanding Lipids, lipid metabolism and enzymes.
2. Understanding basics of plant tissue culture methods.
3. Understanding tools used in genetic engineering.
4. Understanding methods used in herbal technology.

Outcomes: After successful completion of the course the students will be able to

1. Understand basic of biomolecules.
2. Basic concept of Enzymes.
3. Understand basic concepts and methods in tissue culture.
4. Tools in genetic engineering.
5. Construction of genomic library.
6. Use of herbal seeds in cosmetics.
7. Cultivation methods of medicinal plants.

Unit I

Lipids: Definition, properties and role; fatty acids, oils and waxes, beta oxidation andglyoxylic acid cycle.
Enzymology: Definition , nomenclature and classification of enzymes, Characteristics andproperties of enzymes.
Basics of Enzymology: Holoenzyme, Apoenzyme, prosthetic group, Co-enzymes& Co-factors, active site and isozymes.

Mechanism of Action: Enzyme-Substrate Complex Theory, Lock& Key Model, Induced Fit Model.

Enzyme Inhibitors: Definition, competitive and noncompetitive.

Unit II

Plant tissue culture: Definitions of- totipotency, explant, ascetic culture, in vitro, micropropagation; differentiation and morphogenesis.

Methods of sterilization: Autoclaving, dry heat, chemical sterilization. **Culture**

media: MS media (Media preparation and nutrient composition) **Tissue cultures:**

Callus and organ culture (shoot tip, anther) and its application.Protoplast culture and

applications. Application of tissue culture.

Unit III

Genetic engineering: Tools- Enzymes (Restriction enzymes, ligases, DNA polymerases), host.

Cloning vectors: General characters, method of isolation, Plasmid as cloning vectors (pBR^{32})

DNA library: Definition, construction of cDNA and genomic library and their significance.

Agrobacterium mediated gene transfer: Structure of Ti -plasmids, mechanism of transfer.

Role of biotechnology in crop improvement.

Unit IV

Herbal technology: History and importance of herbal technology.

Basic concepts: Drugs, cosmetics, natural dyes, difference between organized and unorganized drugs.

Methods: Cultivation, harvesting, processing, storage and utilization of *Withania somnifera, Aloe vera, Ocimum sanctum.*

Dye yielding herbal plants: *Lawsonia alba(hena), Rivinia humalis ,Indigofera tinctoria*.

Herbs used in cosmetics: *Cocus nucifera, Curcuma longa, Rosa sp., Hibiscus rosa-sinesis.*

List of practicals:

1. To study the activity of enzyme amylase in suitable plant material.
2. To study the activity of enzyme catalase and peroxidase in suitable plant material.
3. To perform micro chemical tests oils/ lipids.
4. To study principle and working of: oven, autoclave, pH meter, laminar air flow.
5. To study the structure of following vectors on the basis of photographs and diagrams: plasmid vector, Ti Plasmid.
6. Extraction and preparation of *Aloe vera* juice from mature leaves of plant.
7. To study methods for preparation of rose water.
8. To study methods for preparation of oil from Hibiscus flower.
9. To study methods of extraction of natural dye from suitable dye yielding plant.

PAPER-II

PHYTOGEOGRAPHY, UTILIZATION OF PLANTS, TECHNIQUES AND PHARMACOGNOSY

Objective: Define and explain about Phytogeographic regions, techniques, medicinal plants.

Course Outcomes: At the end of the course student will able to

1. Learn the various Phytogeographic regions.
2. Understand different types of environmental pollution and its management.
3. Understand about medicinal plants and their uses.
4. Analyze the principal, types and application of instruments.
5. Learn morphology utilization and chemical-constituents of different plants.

Unit I

Phytogeography: Principles of Phytogeography, Distribution (Wides, endemics, discontinuous species), Theories (Land bridge and continental drift), Climatic regions of India, Phytogeographic regions of India (Chatterjee 1962; Name, distribution area, typical vegetation).

Unit II

Utilization of Plants: Morphology, Utilization and Important chemical constituents of :- Food: Wheat; Oil: Groundnut; Fibre: Cotton; Spices: Clove; Beverages: Coffee;Medicinal*: Adhatoda vassica*; and Rubber.

Ethnobotany: Introduction, definition, branches & importance of ethnobotany.

Plants of Ethnobotanical importance: Vegetable, fruits, Seeds, Medicinal and Narcotics(Two plants each with reference to family, parts used and tribal areas)

Unit III

Techniques: Principle, types and application of microscopy (Light, fluorescent, SEM, TEM), Centrifugation, Electrophoresis (SDS-PAGE and Agarose), Spectroscopy (UV- Vis),

Chromatography (Paper chromatography, thin layer chromatography)

UNIT IV: Skill development: Pharmacognosy

Pharmacognosy: Definition and scope,

Drug adulteration: Types

Methods of drug evaluation: Biological testing of herbal drugs, phytochemical screening test for secondary metabolites (Alkaloids and Flavonoids)

Pharmacological plants: Biological source, staining diagnosis, micro-chemical test, chemical constituents, preparation and uses of drug extracted from the plants: *Datura* leaf, *Vinca rosea*, *Plantago ovata* (isapgol) seeds, *Linum usitatissimum* (Linseed) seeds, *Eletteria cardamom* fruit, *Coryandrum sativum* fruit, *Eugenia caryophyllus* (clove), flower bud, *Rauwolfia serpentina* root, *Zingiber officinale* (Ginger) rhizome

List of Practical's

1. To find out the level of noise pollution of different nearby areas with the help of decimeter and compare it with tolerance limit.
2. To study the morphology, utilization and important chemical constituents of plants mentioned in theory (Utilization of plants)
3. To study the plants of ethnobotanical importance of plants under different categories mentioned in theory.
4. Principle and working of: spectrophotometer, microscope, centrifuge and gel electrophoresis apparatus.
5. To study different adulterants used with reference to drug adulteration.
6. To study biological source, chemical constituents, preparation and uses of drugs obtained from plants mentioned in theory.

Semester VI Practical examination Question Paper

Time : 5 hrs **Marks : 30**

Q. 1) To perform the Biochemical Experiment [A] & report the findings	**03**
Q. 2) To perform the Micro-chemical Experiment [A] & report the findings	03
Q. 3) To extract and prepare the herbal product [C] from the given plant material.	**04**
Q. 4) Write about Morphology and utilization of the given plant material [D].	**03**
Q. 5) To prepare the crude drug extract from the given material [E] and mention its use.	04
Q. 6) Spotting:	**05**
F - Biotechnology Instruments	
G – Genetic engineering (Tool)	
H –Herbal Plant	
I – Ethnobotany	
J – Plant used in Pharmacognosy	
Q. 7) Viva Voice	**03**
Q. 8) Practical Record & Excursion Report	**05**

Suggested Readings:

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