Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

M.Sc. Botany

(Based on NEP 2020 framework)

(To be implemented from the Academic Year 2023-24

Semester 1 (First Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4+2)	23ScBotP111	Major Paper 1 (Theory)	Cryptogamic Botany I	4	4	50	50	100
	23ScBotP112	Major Paper 2 (Theory)	Cell Biology and Evolution	4	4	50	50	100
	23ScBotP113	Major Paper 3 (Practical)	Practicals based on Cryptogamic Botany-I	8	4	50	50	100
	23ScBotP114	Major Paper 4 (Practical/)	Practicals based on Cell Biology and Evolution	4	2	25	25	50
Major Electives (4)	23ScBotP121	Major Elective 1 (T)	Plant Metabolism	4	4	50	50	100
	23ScBotP122	Major Elective 2 (T)	Botanical Techniques	4				
RM (4)	23ScBotP131	RM Paper 1	RM Core Paper	2	4	50	50	100
	23ScBotP131	RM Paper 2	Plant Tissue Culture Techniques	2				
OJT(4),		–	–	–	–	–	–	–
Total				28	22	275	275	550

Semester 2 (First Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4+2)	23ScBotP211	Major Paper 1 (Theory)	Cryptogamic Botany II	4	4	50	50	100
	23ScBotP212	Major Paper 2 (Theory)	Biochemistry	4	4	50	50	100
	23ScBotP213	Major Paper 3 (Practical)	Practicals based on Cryptogamic Botany II	8	4	50	50	100
	23ScBotP214	Major Paper 4 (Practical)	Practicals based on Biochemistry	4	2	25	25	50
Major Electives (4)	23ScBotP221	Major Elective 1 (T)	Genetics and Plant Breeding	4	4	50	50	100
	23ScBotP222	Major Elective 2 (T)	Molecular Biology	4				
RM (4)		–	–	–	–	–	–	–
		–	–	–				
OJT(4),	23ScBotP241	OJT	On Job Training	8	4	50	50	100
Total				32	22	275	275	550

Exit option: P.G. Diploma in Botany (44 credits) after Three Year UG Degree

Semester 3 (Second Year)

Course Type	Code	Course	Course / Paper Title	Hours/ Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4+2)	23ScBotP311	Major Paper 1 (Theory)	Spermatophytic Botany	4	4	50	50	100
	23ScBotP312	Major Paper 2 (Theory)	Plant Ecology and Phytogeography	4	4	50	50	100
	23ScBotP313	Major Paper 3 (Practical)	Practicals based on Spermatophytic Botany	8	4	50	50	100
	23ScBotP314	Major Paper 4 (Practical)	Practicals based on Plant Ecology and Phytogeography	4	2	25	25	50
Major Electives (4)	23ScBotP321	Major Elective 1 (T)	Developmental Botany	4	4	50	50	100
	23ScBotP322	Major Elective 2 (T)	Genetic Engineering	4				
RP (4)	23ScBotP352	RP	Research Project	8	4	50	50	100
OJT(4),								
Total				32	22	275	275	550

Semester 4 (Second Year)

Course Type	Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4+4)	23ScBotP411	Major Paper 1 (Theory)	Computational Botany	4	4	50	50	100
	23ScBotP412	Major Paper 2 (Theory)	Industrial Botany	4	4	50	50	100
	23ScBotP413	Major Paper 3 (Practical)	Practicals based on Computational Botany	8	4	50	50	100
Major Electives (4)	23ScBotP421	Major Elective 1 (T/P)	Plant Biotechnology	4	4	50	50	100
	23ScBotP422	Major Elective 2 (T/P)	Plant Pathology and Plant Protection	4				
RP (4)	23ScBotP452	RP	Research Project	12	6	75	75	150
OJT(4),								
Total				32	22	275	275	550

P.G. Degree in Botany (88 credits) after Three Year UG Degree

OE : Open Elective
AEC: Ability Enhancement Course
VEC: value Education Courses
CC : Co-Curricular Courses
IKS : Indian Knowledge System
OJT : On Job Training
FP : Field Project
VSC : Vocational Skill Courses
CEP : Community Engagement Project

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PG Part 1 / M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code :23ScBotP111 **Course Name: Cryptogamic Botany I- Algae, Fungi, Lichens and Bryophytes**

Teaching Scheme: TH: 4 Hours/Week **Credit: 04**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- Student should have basic knowledge of Algae, Fungi and lichens of undergraduate level.

Course Objectives:

- To study general characteristics of each group of Algae.
- To learn evolutionary relationship among taxa within each group
- To gain expertise in the field work

Course Outcomes:

On completion of the course, student will be able to–

- Identify and classify lower cryptogams

Course Contents

Unit 1	**Systematics and taxonomy of algae**	**2 Lectures**
	1.1 Concept of algal systematics 1.2 Position of algae and fungi in five Kingdom System 1.3 Economic importance of algae 1.4 Algal biofertilizers 1.5 Mass cultivation of sea weeds.	
Unit 2	**Classification of Algae**	**4 Lectures**
	2.1 Outline of classification of algae 2.2 Role of pigment constitution and reserve food in algae.	

Unit 3	**Recent studies in phycology**	**3 Lectures**
	3.1 Recent algological studies in India. 3.2 Modes of perennation in algae. 3.3 Origin and evolution of sex and thallus in the algae 3.4 Fossil algae	
Unit 4	**Cyanophyta (Blue Green Algae)**	3 Lectures
	4.1 Distinguishing characters. 4.2 Thallus organization, cell structure, heterocyst and its significance. 4.3 Structure and reproduction in Chrococcales, Nostocales, and Stigonematales.	
Unit 5	**Chlorophyta (Green Algae)**	**3 Lectures**
	5.1Distinguishing characters. 5.2 Origin of green algae 5.3 Range of thallus organization in Chlorophyta 5.4 Reproduction – asexual and sexual, Life cycle pattern in unicellular, filamentous and multicellular green algae.	
Unit 6	**Charophyta**	**3 Lectures**
	6.1 Distinguishing characters, comparative study of thallus structure in *Chara* and *Nitella* 6.2 Reproduction and Life cycle pattern.	
Unit 7	**Phaeophyta (Brown algae)**	**3 Lectures**
	7.1 Distinguishing characters. 7.2 Comparative study of thallus morphology, anatomical peculiarities, reproduction and life cycle patterns.	
Unit 8	**Rhodoophyta: (Red algae)**	**3 Lectures**
	8.1 Distinguishing characters. 8.2 Comparative study of thallus morphology, anatomical peculiarities, reproduction and life cycle patterns.	

Unit 9	**Diatoms**	**2 Lectures**
	9.1 Xanthophyta 9.2 Bacillariophyta 9.3 Chrysophyta.	
Unit 10	**Lichens**	**4 Lectures**
	10.1 History of Lichenology 10.2 Types and classification of lichens, nature of association 10.3 Morphology and anatomy of lichen thallus, reproduction 10.4 Economical and ecological importance.	
Unit 11	**Fungi**	**4 Lectures**
	11.1 Outline of classification of fungi 11.2 Recent studies of fungi in India 11.3 Distinguishing characters 11.4 Thallus: unicellular and multicellular filamentous, nutrition, cell structure, hyphal modifications in fungi, phylogeny of fungi 11.5 Economic importance.	
Unit 12	**Myxomycotina and Mastigomycotina**	**3 Lectures**
	12.1 Myxomycotina: Distinguishing characters, comparative study of structure of thallus and reproductive bodies, life cycle pattern 12.2 Mastigomycotina: Distinguishing characters, comparative study and Evolution of thallus structure and reproduction (asexual and sexual), Life cycle pattern in Chytridiomycetes and Oomycetes.	
Unit 13	**Zygomycotina**	**2 Lectures**
	13.1 Zygomycotina - Distinguishing characters, thallus structure, heterothallism and sexual reproduction 13.2 Evolution of asexual reproduction 13.3 Life cycle pattern.	

Unit 14	**Ascomycotina**	**3 Lectures**
	14.1 Distinguishing characters. 14.2 Comparative study of thallus structure, evolution of sexuality, 14.3 Concept of hamathecium and centrum, fructifications. 14.4 Life cycle pattern in Hemiascomycetes and Euascomycetes.	
Unit 15	**Basidiomycotina**	**3 Lectures**
	15.1 Distinguishing characters. 15.2 Thallus structure, types and structure of basidia and basidiocarps. 15.3 Life cycle pattern in Teliomycetes, Hymenomycetes and Gasteromycetes.	
Unit 16	**Deuteromycotina**	**2 Lectures**
	16.1 Distinguishing characters 16.2 Thallus structure, fructifications, types of conidia, conidial ontogeny 16.3 Life cycle patterns.	
Unit 17	**Bryophytes**	**2 Lectures**
	17.1 Outline of Classification of Bryophyte. 17.2 Contributions of any three Bryologists from India.	
Unit 18	**Hepaticopsida**	**3 Lectures**
	18.1 Distribution 18.2 Distinguishing Characters 18.3 Morphology and anatomy of gametophyte and sporophytes of liverworts, Takaiales, Jungermanniales, Marchantiales, Sphaerocarpales.	
Unit 19	**Anthocerotopsida**	**3 Lectures**
	19.1 Distribution. 19.2 Distinguishing Characters 19.3 Morphology and anatomy of gametophyte and sporophyte in Anthocerotales, Biological importance of *Anthoceros* sporophyte.	

Unit 20	Bryopsida/Musci	5 Lectures
	20.1 Distribution 20.2 Distinguishing Characters 20.3 Morphology and anatomy of gametophyte and sporophytes of Sphangnales, Funariales, Polytrichales, Eubryales.	

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7. **Dube H.C. (2004).** An Introduction to fungi. Vikas Publishers.
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14. **Alexopolous C.J., Minms C.W. and Blackwell M. (1999).** (4th edn) IntroductoryMycology. Willey, New York, Alford R.A.
15. **Deacon J.W. (2006).** Fungal Biology (4th Ed.) Blackwell Publishing, ISBN. 1405130660.
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PG Part 1 M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP112 **Course Name : Cell Biology and Evolution**

Teaching Scheme: TH:4 (Hours/Week) **Credit :04**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- A student should know basic concept of cell studied at undergraduate level.

Course Objectives:

- To study ultrastructure of cell organelles and functions
- To learn basic metabolism of cell
- To understand advanced trends of cell biology

Course Outcomes:

On completion of the course, student will be able to:

- understand the structure and functions of cell organelles
- understand the metabolism of cell organelles
- grasp the current trends in cell Biology

Course Contents

Unit 1	**Cell Wall**	**3 Lectures**
	1.1 Biogenesis, ultra-structure and functions 1.2 Growth- primary and secondary cell wall.	
Unit 2	**Cell membranes**	**4 Lectures**
	2.1 Molecular organization, fluid mosaic model, membrane protein diffusion 2.2 Electrical properties of membranes transport across membranes, facilitated diffusion, carrier and channel proteins, transporters, active transport, transport of ions and solutes	

Unit 3	**Cell Organelles-I**	**8 Lecture**
	3.1 Endoplasmic reticulum: Ultra structure of ER, Role in synthesis and transport of secretary proteins **3.2 Golgi complex:** Ultra structure of golgi complex, Role in sorting, storage and secretion **3.3 Lysosomes:** Ultra structure of lysosomes, membrane integrity and role **3.4 Glyoxysomes and Peroxisomes:** Structure and functions Ultra structure of Chloroplast and Mitochondria. Molecular organization and biogenesis of chloroplast and mitochondrial membrane.	
Unit 4	**Cell organelles - II**	**7 Lecture**
	4.1 Nucleus: Structure, Organization and regulation of nuclear pore complex, Transport across nuclear membrane **4.2 Ribosome:** Structure, assembly and dissociation of subunits, function **4.3 Vacuoles:** biogenesis, transporters, Mechanism of sorting and regulation of intracellular transport, Role as storage organelle, Transport across vacuolar membrane.	
Unit 5	**Cytoskeleton and Signal Transduction**	**8 Lecture**
	5.1 Cytoskeleton: Composition and organization of microtubules, microfilaments, signaling and intracellular traffic, Role in motility, flagella- Structure and organization, Intermediate filaments. **5.2 Plasmodesmata:** Structure and role in movement of molecules, virus transport **5.3 Signal Transduction:** Types of receptors, G-proteins and G-protein coupled receptors **5.4 Signaling mechanisms:** Phospholipid signaling, Ca^{2+}, Calmodulin cascade, Diversity in protein kinases and phosphatases, secondary messengers, regulation of signaling pathways	

	Specific signaling mechanisms with suitable examples- Biotic and abiotic stress, ABA induced stomatal closure, Stomatal guard cell signaling 5.4.1 Nuclear- organelle signaling during plastid development 5.4.2Receptor Serine/ Threonine kinase, Ethylene mediated two component system.	
Unit 6	**Cell Cycle**	**8 Lecture**
	6.1 Phases of cell cycle, functional importance of each phase, Molecular events during cell cycle, 6.2 Regulation of cell cycle, Cyclins and protein kinases, MPF (Maturation promoting factor), 6.3 Methods to study cell cycle- labeled mitotic curve, flow cytometry, use of mutants.	
Unit 7	**Cell aging and cell senescence**	**7 Lecture**
	7.1Programmed cell death: molecular aspects, regulation of cell death, PCD in response to stress 7.2 Apoptosis: Role of different genes, cell organelles during apoptosis, genetic control of apoptosis.	
Unit 8	**Origin of Life**	**3 Lecture**
	8.1 Emergence of evolutionary thought: Steps and preview of evolution, Lamarkism 8.2 Darwinism- concepts of variation, adaption, struggle for fitness and natural selection; Neo Darwinism, Spontaneity of mutations 8.3 The evolutionary synthesis	
Unit 9	**Theories of Evolution**	**4 Lecture**
	9.1 Origin of cells and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of organic monomers and polymers 9.2 Concepts of Oparin and Halden, Miller Experiment (1953), The first cell,	

	evolution of prokaryote, origin of eukaryotic cells, evolution of unicellular eukaryotes, anaerobic metabolism 9.3 Photosynthesis and aerobic metabolism, RNA world theory.	
Unit 10	**Molecular Evolution**	**3 Lecture**
	10.1 Concepts of natural evolution, molecular clocks, molecular tools in phylogeny 10.2 Protein and nucleotide sequence analysis, origin of new genes and proteins, gene duplication and divergence.	
Unit 11	**The mechanism of evolution**	**5 Lecture**
	11.1Population genetics: Types of population's gene pool, gene frequency, 11.2 Hardy-Weinberg law, Concepts natural selection, Changes in gene frequency through, migration and random genetic drift. Adaptive radiation and modification, isolation mechanism. Speciation-allopatric sympatric, and parapetric, convergent evolution and co-evolution.	

References:

1. **Alberts B., Bray D., Lewis J., Raff M., Roberts K., Watson J.D. (1989).** Molecular Biology of the Cell. 2nd Edn. Garlan Publ. Inc. New York.

2. **Karp G. (1999).** Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.

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PG Part 1 / M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP113 **Course Name: Practical based on Cryptogamic Botany-I**

Teaching Scheme: PR: 8 Hours/Week **Credit-04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

(24 Practicals)

Algae

1. Morphological observations, documentation (description and illustrations) and classification according to Fritsch with reasons of taxa belonging to (At least one example from each order):

- Chlorophyta- Any eight forms, Charophyta - Any two forms 3P
- Phaeophyta - Any five forms 1P
- Rhodophyta - Any five forms 1P
- Cyanophyta- Any five forms 1P
- Minor Groups - Any three forms 1P

Note: Collection tour to any marine/oceanic habitat to collect algae is compulsory

Fungi

1. Preparation of cotton blue, Lactophenol and culture medium - PDA 1P
2. Study of Lichens -Any three forms 1P
3. Study of representative genera belonging to following subdivisions of fungi with respect to vegetative, reproductive structures and classification with reasons according to Ainsworth et al. (1973) (At least one example from each class):

- Myxomycotina and Deuteromycotina -Any three forms 1P
- Mastigomycotina and Zygomycotina - Any five forms 1P
- Ascomycotina - Any five forms 2P
- Basidiomycotina- Any five forms 2P

Note: Collection tour to any forest to observe, collect fungi and lichens and submission of ten specimens and excursions report is compulsory.

Bryophytes

Morphological, anatomical and reproductive studies of Bryophytes:

1.Hepaticopsida*: Asterella, Plagiochasma, Marchantia, Targionia, Cyathodium, Fossombronia,* Pallavicinia*, Riccardia* and *Metzeria, Porella* and *Fruillania* (Any six forms) 5P
2. Anthocerotopsida: *Anthoceros* and *Notothylus.* 1P
3. Musci: *Sphagnum, Funaria, Polytrichum, Pogonatum, Bryum* (Any four forms) 2P
Note: Excursion report on studies of Bryophytes from Western Ghat is compulsory. Submission of any five photographs of Bryophytes form each

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PG Part 1 / M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP114 **Course Name: Practical based on Cell Biology and Evolution**

Teaching Scheme: PR: 8 Hours/Week **Credit-02**
Examination Scheme: CIA : 50 Marks **End-Sem : 25 Marks**

12 Practicals

1. Isolation of Chloroplasts to study: 4P
   - Hill reaction to measure intactness
   - Chlorophyll estimation

2. Isolation of mitochondria for: 2P
   - Estimation of succinic dehydrogenase activity

3. Estimation of acid phosphatase activity. 2P
4. Study of Electron Micrographs of cell organelles. 2P
5. Isolation of protoplasts and viability staining to determine % viability. 2P
6. Cytochemical / Histochemical studies of special cell types: guard cells, senescent cells, bundle sheath cells, meristematic cells, laticiferous cells, glandular cells, pollen grains. 4P
7. Study of induced cell senescence in leaf discs. 2P
8. Isolation of lysosomal fraction and estimation of acid phosphatase activity. 2P
8. Study of different plant fossils with respect to evolution- 2P
   - Impression
   - Compression
   - Petrification
   - Coal ball

9. Geological Time Scale 2P

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PG Part 1 M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code: 23ScBotP121 **Course Name: Plant Metabolism**

Teaching Scheme: TH: 4(Hours/Week) **Credit :04**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- A student should have a basic knowledge of Plant Physiology.

Course Objectives:

- To understand the interaction between the environment and plant growth
- To study the metabolic and physiological processes in plants

Course Outcomes:

On completion of the course, student will be able to–

- understand interrelationship between plant metabolism and development
- understand several major areas of active investigation in contemporary plant biology

Course Contents

Unit 1	**Introduction to metabolism and energy**	**3 Lectures**
	1.1 The flow of energy in living system 1.2 The laws of thermodynamics and concepts of free energy 1.3 ATP: The energy currency of cell. 1.4 The natures of metabolism.	
Unit 2	**Solute transport**	**3 Lectures**
	2.1Transport of ions across membranes 2.2 Membrane transport processes and proteins 2.3Ion transport in roots.	

Unit 3	**Photosynthesis**	**9 Lectures**
	3.1 Chloroplast and photosynthetic pigments system 3.2 Concept of photosynthetic unit 3.3 Hill reaction 3.4 Oxygenic and anoxygenic photosynthesis 3.5 Stages of photosynthesis 3.6 Photorespiration 3.7 C_3 and C_4 pathways 3.8 CAM pathway.	
Unit 4	**Sensory photobiology**	**3 Lectures**
	4.1 Plant responses to light and gravity, mechanical stimuli, water and temperature. 4.2 Role of PGRs in sensory system.	
Unit 5	**Plant water relations**	**4 Lectures**
	5.1 Soil water and its absorption by roots 5.2 Transport of water 5.3 Water movement from the leaves to the atmosphere 5.4 An overview of the soil–plant–atmosphere continuum.	
Unit 6	**Respiration**	**8 Lectures**
	6.1Glycolysis 6.2 Fermentation 6.3 Aerobic respiration 6.4 Shuttle system 6.5 Electron transport chain and oxidative phosphorylation 6.6 Respiratory quotient and respiratory substrate 6.7 Glyoxylate cycle 6.8 Pentose phosphate pathway.	

Unit 7	**Stress physiology**	**5 Lectures**
	7.1 Response of plant to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses 7.2 Mechanism of resistance to biotic stress and tolerance to abiotic stress 7.3 Physiological process affected by drought Mechanism of drought tolerance.	
Unit 8	**Plant growth regulators**	**7 Lectures**
	8.1Classification 8.2 Site of synthesis 8.3 Biosynthetic pathways of PGRs and their metabolism 8.4 Influence of auxins, gibberellins, cytokinins, ethylene and abscisic acid on plant growth and development 8.5 Introduction to Brassinosteroids, Triacontanol, Phenols Polyamines, and Jasmonates 8.6 Concept of death hormone.	
Unit 9	**Seed germination flowering & fruit ripening**	**3 Lectures**
	9.1 Metabolic changes during seed germination 9.2 Seed viability and seed dormancy 9.3 Means to overcome seed dormancy 9.4 Initiation of flowering.	
Unit 10	**Secondary metabolites and plant defense**	**4 Lectures**
	10.1 Secondary metabolites-structure and synthesis 10.2Induced plant defenses against insect and herbivores 10.3Plant defenses against pathogens.	

Unit 11	**Post-harvest technology of fruits**	**4 Lectures**
	11.1 Physiological changes during ripening 11.2Artificial v/s natural ripening of fruits 11.3Fruit preservation 11.4Role of ethylene in post-harvest technology 11.5 Cold chain 11.6 Centralised packing operations.	
Unit 12	**Equipment used in plant metabolism study**	**7 Lectures**
	Working and Principle of: 12.1Grain moisture meter (Capacitance meter) 12.2Turbidity meter (PAR meter) 12.3Chlorophyll fluorometer 12.4Lux meter 12.5Infrared pyrometer 12.6Infrared gas analyzer (IRGA) 12.7Leaf area meter 12.8Portable pigment analyzer.	

References:

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PG Part 1 of M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code: 23ScBotP122 **Course Name: Botanical Techniques**

Teaching Scheme: TH: 4 Hours/Week **Credit :04**

Examination Scheme: CIA: 50 Marks **End-Sem: 50 Marks**

Prerequisite Courses:

- A student should have basic knowledge of equipment's

Course Objectives:

- To study principles and application of equipment's used in life science

Course Outcomes:

On completion of the course, student will be able to–

- Know the principles and application of equipment's

Course Contents

Unit 1	**Microscopy**	**8 Lecture**
	1.1 Image formation (properties of light), Lens- refraction, dispersion of light, objects, images, image quality, magnification concept, resolution 1.2 Light microscopy, Confocal microscopy, Phase Contrast microscopy, Fluorescence microscopy, Electron microscopy (SEM and TEM), Flow cytometry.	
Unit 2	**Microtomy, Histochemical and Cytochemical techniques**	**7 Lecture**

	2.1 Dissection, maceration, squash, peeling and whole mount- pretreatment and procedures 2.2 Serial sectioning, double or multiple staining, Lesser assisted Microtomy 2.3 Localization of specific Compounds/reactions/ activities in tissues and cells.	
Unit 3	**Chromatography techniques**	**8 Lecture**
	3.1 Introduction, concept of partition coefficient, Paper, TLC, Column, Gel filtration 3.2 Affinity, Ion exchange, HPLC 3.3 Gas chromatography (Principle, method and applications of each).	
Unit 4	**Electrophoretic techniques**	**7 Lecture**
	4.1 History, Principles, Agarose gel electrophoresis, Pulsed Field Gel Electrophoresis, Polyacrylamide Gel Electrophoresis (PAGE/ Native) 4.2 Sodium Dodecyl Sulphate polyacrylamide gel electrophoresis (SDS-PAGE/ Denaturing), 4.3 Isoelectric focusing, 2Dimensional Gel Electrophoresis (2-D method).	
Unit 5	**Spectroscopic techniques**	**9 Lecture**
	5.1 General principles, Beer and Lambert's Law, Molar extinction coefficient, Spectrophotometer (working and application) 5.2 UV-Visible spectroscopy, Nuclear Magnetic 5.3 Resonance (NMR) spectroscopy, 5.4 X-ray crystallography, Spectro-flurometry 5.5AAS, MS, IR Spectroscopy.	
Unit 6	**Radioactive techniques**	**6 Lecture**
	6.1 Radioisotopes used in biology and their properties 6.2 Units of radioactivity, Interaction of radioactivity with matter,	

	6.3Detection and measurement of radioactivity, Autoradiography 6.4Safe handling of radio isotopes, Non-Radio labeled techniques.	
Unit 7	**Centrifugation techniques**	**4 Lecture**
	7.1 Principles, Rotors, Factors affecting centrifugation, Ultra-centrifugation, 7.2 Density Gradient Centrifugation, High speed centrifuges.	
Unit 8	**Electrochemical techniques**	**3 Lecture**
	8.1 Electrical conductivity 8.2 pH meter, 8.3 Oxygen electrode.	
Unit 9	**Immunological techniques**	**4 Lecture**
	9.1Principles, Antigen–antibody interaction, 9.2 Immuno diffusion, Immuno precipitation, 9.3Radio-immuno assay, Rocket immumo-electrophoresis, ELISA	
Unit 10	**Molecular biology techniques**	**5 Lecture**
	10.1 DNA sequencing techniques- Sanger's method, 10.2 Maxam- Gilbert's method, Automated DNA sequences, Pyrosequencing, 10.3 Sequencing of proteins, PCR, 10.4 DNA microarray	

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PG Part 1

(2023 Course under NEP 2020)

Course Code : 23ScBotP131 Course Name : ResearchMethodology

Section 1

Teaching Scheme: 2 Hours/Week **Credit : 02**

Examination Scheme: CIA :25 Marks **End-Sem : 25 Marks**

Prerequisite Courses:

- B.A., B.Sc. B.Com,B.Voc., BBA, BBA IB, BBA CA

Course Objectives:

- To make students aware about research and its importance
- To obtain knowledge regarding systematic gathering of data and get advanced knowledge in the selected topic
- Toinculcatelogical and organized thinking in students
- To investigate some existing situation or problem by creating new system or method
- To help students to design research problem

Course Outcomes:

On completion of the course, student will be able to–

1. Describe importance of research
2. Differentiate between unethical and ethical practices of publication ethics
3. Select research problem appropriately
4. Prepare good hypothesis
5. Design research problem systematically
6. Analyze and organize data correctly
7. Prepare good scientific research report

Course Contents

Unit 1	Research problem and design	No. of lectures
	Introduction to research :meaning and definition	**15**

	of research, objective of research, importance of research, characteristics of good research, purpose and role of research, classification of research **Research problem :** defining of research problem, Criteria for selecting the research problem, , importance of literature survey in defining research problem. Hypothesis :Defining Hypothesis, types of hypothesis, characteristics of good hypothesis, formulation of hypothesis **Research Design :**Definition and features of research design, Concept of research design, types of research design, preparation of research design, Sampling techniques, characteristics of good sampling designs	
Unit 2	**Data analysis, report writing and publication ethics**	**15**
	Definition of Data, methods of data collection, analysis of data, types of data analysis, Questionnaire, Design of Questionnaire, Testing hypothesis : parametric and non-parametric tests : T-test, Z-test, Chi-square test, ANOVA **Report writing** : importance of interpretation of results, meaning, definition and significance of report /thesis writing, Principals of research report drafting, Types of reports, layout of research report, important parts of reports, precautions of preparation of report/ thesis **Publication ethics :**definition, introduction and importance, best practices/ standard settings initiative and guidelines COPE, WAME, etc, conflict of interest, Publication misconduct :definition, concept problems that lead to unethical behavior, violation of publication ethics, predatory publishers and journals, software tools to identify predatory publications developed by SPPU	

References :

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PG Part 1 M.Sc. (2023 Course under NEP 2020)

Course Code : 23ScBotP131 **Course Name : Plant Tissue Culture Techniques**

Section 2

Teaching Scheme:TH 02 Hours/Week **Credit:02**

Examination Scheme: CIA : 25 Marks **End-Sem : 25 Marks**

Prerequisite Courses:

- Student should have basic knowledge of Plant Tissue Culture

Course Objectives:

- To develop practical skills for sterile laboratory techniques, media preparation, and culture maintenance.
- To enable students to understand and apply tissue culture techniques for plant propagation, genetic transformation, and conservation.

Course Outcomes:

On completion of the course, student will be able to–

- familiarize with the techniques and protocols used in plant tissue culture.
- adopt critical thinking and problem-solving abilities through the analysis of tissue culture experiments and research papers.

Course Contents

Unit 1	**Introduction to plant tissue culture:**	**3 lectures**
	1.1 Historical background and significance of plant tissue culture 1.2 Basic principles of cell and tissue culture 1.3 Types of explants and their preparation 1.4 Callus formation and organogenesis	
Unit 2	**Laboratory Organization**	**3 lectures**
	2.1 Design and layout for wash area, 2.2 Media preparation, sterilization and storage room, transfer area for aseptic manipulations, 2.3 Culture rooms, and observation/data collection areas. 2.4 Labwares, Good laboratory practices, Good safety practices	

Unit 3	**Sterile Techniques and Media Preparation**	**4 lectures**
	3.1 Sterilization methods for explants and culture vessels 3.2 Preparation of culture media and nutrient formulations 3.3 Hormones and growth regulators in tissue culture: Role of Plant hormones (auxins, cytokinins, abscissic acid, ethylene and Gibberellins) in plant development	
Unit 4	**Asceptic Techniques for the establishment and maintenance of cultures**	**4 lectures**
	4.1 Methods of sterilization of equipments, culture media and explants:- 4.2 Washing and preparation of glassware's, packing and sterilization, media sterilization, surface sterilization, aseptic workstation, precautions to maintain aseptic conditions	
Unit 5	**Plant Regeneration Techniques**	**6 lectures**
	5.1 Micropropagation techniques for clonal propagation 5.2 Shoot tip or axillary bud culture proliferation 5.3 Micropropagation stage II-Subculture & multiplication of culture.	
Unit 6	**Rooting**	**4 lectures**
	5.1 In vitro rooting: use of PGRs, effect of media, use of alternative substrates (perlite, vermiculite), use of activated charcoal, culture environment 5.2 Ex-vitro rooting: Advantages of microcutting rooting, use, composition of sowing mixtures and additives, culture environment	
Unit 6	**Hardening and acclimatization**	**3 lectures**
	6.1 Need for hardening micropropagated plantlets: Reasons: water stress, cuticle, stomata. 6.2 Acclimatization: Techniques in acclimatization	
Unit 7	**Applications of Tissue Culture**	**3 lectures**
	7.1 Tissue culture in plant breeding and hybridization 7.2 Disease elimination and virus-free plant production 7.3 Conservation and restoration of	

	endangered species	

References:

1. **M. K. Razdan (2002).** Introduction to Plant Tissue Culture
2. **S.S. Bhojwani (1983).** Plant tissue Culture: Theory and Practice.
3. **H.D. John and W.R. Lorin (1995).** Experiments in Plant tissue Culture, 3rd Edition

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PG Part 1 M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP211 **Course Name : Cryptogamic Botany II (Pteridophytes, Gymnosperms& Paleobotany)**

Teaching Scheme: TH:4 (Hours/Week) **Credit 04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisite Courses:

- Student should have basic knowledge of classification of Pteridophytes and Gymnosperms

Course Objectives:

- To study general characteristics of each group with one example each
- To learn evolutionary relationship between the taxa
- To be expertise in field work

Course Outcomes:

On completion of the course, student will be able to–

- Identify and classify the biological specimens in nature.
- Collect, preserve and have his own start up

Course Contents

Unit 1	**Pteridophytes**	**5 Lectures**
	1.1 Distinguishing characters. Apospory, Apogamy, parthenogenesis, Telome theory, Stelar and soral Evolution 1.2 Gametophytes in Pteridophytes- homosporous and heterosporous	
Unit 2	**Classification of Pteridophytes**	**5 Lectures**
	2.1 Outline of Classification of pteridophytes. 2.2Economic importance of pteridophytes.	

Unit 3	**Psilopsida**	**5 Lectures**
	3.1 Distribution 3.2 Distinguishing characters Comparative study of sporophyte and gametophyte of *Psilotum* and *Tmesipteris*	
Unit 4	**Lycopsida**	**5 Lectures**
	4.1 Distribution 4.2 Distinguishing characters Affinities, comparative study of sporophyte and gametophyte of Lycopodiales, Selaginellales, Isoetales, Life cycle patterns	
Unit 5	**Sphenopsida**	**5 Lectures**
	5.1Distribution 5.2 Distinguishing characters Comparative study of sporophyte and gametophyte, Life cycle Pattern Equisetales	
Unit 6	**Pteropsida/Filicophyta**	**5 Lectures**
	6.1 Distribution 6.2 Distinguishing Characters Comparative study of sporophyte and gametophyte of order Ophioglossales Osmundales ,Filicales ,Marsileales , Salviniales	
Unit 7	**Classification Gymnospermns**	**10 Lectures**
	7.1 Outline classification of Spermatophyta. 7.2 Gymnosperm classification as per Sahni (1920), Chamberlain (1934), Raizda and Sahni (1960), Sporne (1965) and Bierhorst (1971) 7.3 Distribution of gymnosperms- Worldwide and in India, Economic aspects of gymnosperms	
Unit 8	**General characters**	**5 Lectures**
	8.1 Affinities, morphology of sporophytes and gametophytes of living gymnosperm orders 8.1.1 Cycadales 8.1.2 Ginkgoales 8.1.3 Coniferals 8.1.4 Gnetales,Ephedrales	

	Welwitschiales	
Unit 9	**Paleobotany- Fossil Pteridophytes**	**7 Lectures**
	9.1 Psilopsida :- *Rhynia* 9.2 Lycopsida :- *Lepidodendron, Lepidophyllum, Stigmaria, Lepidostrobus, Lepidocarpon, Sigillaria.* 9.3 Sphenopsida :- *Calamites, Annularia, Calamostach, Cheirostrobus.*	
Unit 10	**Paleobotany- Fossil Gymnosperms**	**8 Lectures**
	10.1Cycadeoidales: General characters, structure of *Cycadeoidea* and *Williamsonia* 10.2Pentoxylales: General characters, Pentoxylon, structure of secondary wood, male and female strobili, and contribution of Birbal Sahni 10.3 Cordaitales:General characters, structure of *Cordaites* and *Cordaitanthus*	

References:

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PG Part 1 M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP212 **Course Name : Biochemistry**

Teaching Scheme: TH: 4 (Hours/Week) **Credit :04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisite Courses:

- A student should have basic knowledge of structure of atoms, molecules, and their functions, and various life processes.

Course Objectives:

- To study the molecular composition of living cells, the organization of biological molecules within the cell, and the structure and function of these biological molecules.
- To learn the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways.

Course Outcomes:

On completion of the course, student will be able to:

- Understand the behavior of biological macromolecules

Understand enzymes and cellular dynamics.

Course Contents

Unit 1	**Water and buffers**	**3 Lectures**
	1.1 Structure and properties of water 1.2 Water as biological solvent Ionization of water, acids and bases, pH, buffers	
Unit 2	**Bioenergetics**	**3 Lectures**
	2.1 Structure of atoms, molecules and chemical bonds 2.2 Principles of thermodynamics 2.3 Concept of free energy, changes in free energy during chemical reactions, entropy and enthalpy	

	2.4 Redox potentials 2.5 Dissociation and associations constants 2.6 Activation energy and binding energy	
Unit 3	**Enzymology**	**5 Lectures**
	1 Classification and properties of enzymes, units of enzyme activity, factors affecting enzyme activity 3.2 Enzyme Kinetics- substrate concentration and rate, Michaelis – Menton equation 3.3 Competitive, uncompetitive and non-competitive inhibitors 3.4 Covalent and allosteric regulation. coenzymes, isoenzymes and co-factor	
Unit 4	**Carbohydrates**	**4 Lectures**
	4.1 General classification, structure, general properties and functions of polysaccharides and complex carbohydrates 4.2 Synthesis and breakdown of carbohydrates (starch, glycogen and pectin)	
Unit 5	**Amino acids and proteins**	**8 Lectures**
	5.1 General classification of amino acids and proteins 5.2 Structure, synthesis and properties of amino acids 5.3 Proteins – Peptide synthesis: chemical and Merrifield synthesis. Primary (peptide conformation, N- and C-terminal, peptide cleavage), Secondary (α-helix, beta sheets, and random coil,), tertiary and quaternary structures of proteins 5.4 Ramachandran plot	
Unit 6	**Metabolism of nucleic acids**	**7 Lectures**
	6.1 Structure and function of nucleotides. 6.2 Primary, secondary and tertiary structure of nucleic acids, DNA forms and conformations, Denaturation of	

	DNA, RNA, Purines, Pyrimidines, their biosynthesis and metabolism	
Unit 7	**Nitrogen metabolism**	**3 Lectures**
	7.1 Importance of nitrogen in biological systems 7.2 , nitrogen cycle 7.3 Nitrogen fixation; symbiotic and non-symbiotic, nitrogenase complex, energetics and regulation 7.4 Formation of root nodules in legumes Assimilation of nitrate and ammonium ion	
Unit 8	**Secondary metabolites**	**5 Lectures**
	8.1General classification of major pathways: Phenolics (Lignins, tannins) Flavonoids, terpenoids (steroids), Alkaloids, pigments (Carotenoids, Anthocynins)	
Unit 9	**Lipid metabolism**	**7 Lectures**
	9.1 Classification, structure, properties and functions of fatty acids, essential fatty acids, fats, phospholipids, sphingolipids, cerebrocides, steroids, bile acids, prostaglandins, lipoamino acids, lipoproteins, proteolipids, phosphatidopeptides and lipopolysaccharides.	
Unit 10	**Radioactivity**	**5Lectures**
	10.1 Radioactivity measuring techniques and correction factors 10.2 Application of isotopes in biochemical analysis, isotope dilution techniques and autoradiography Radioisotopes in biochemistry and medicine.	
Unit 11	**Spectroscopy**	**10Lectures**

	11.1 Concept of spectroscopy, electromagnetic spectrum 11.2 Beer – Lamberts law, principles and applications of colorimetry, UV-VIS spectrophotometry 11.3 Concepts of fluorimetry, flame photometry, AAS, AES, Infrared, ESR, NMR, CD & ORD and X – ray diffraction 11.4 Flowcytometry, cell sorting and their applications	

References:

1. **Berg J.M., Tymoczko J.L., Stryrer L. (2002)** Biochemistry. 5th Ed. Wlt. Freeman and Company, New York.

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PG Part 1 / M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP213 **Course Name: Practical Based on Cryptogamic Botany II**

Teaching Scheme: PR: 8 Hours/Week **Credit 04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

(24 practicals)

Practicals based Pteridophytes, Gymnosperms and Paleobotany

Pteridophytes

A. Morphological, anatomical and reproductive studies of Pteridophytes:

1. Psilopsida: *Psilotum* and *Tmesipteris* (Figure of *Tmesipteris* must be shown) 1P
2. Lycoposida and Sphenopsida: *Lycopodium*, *Selaginella*, *Equisetum*, *Isoetes* 4P
3. Pteropsida: *Ophioglossum, Angiopteris, Osmunda, Salvia, Azolla, Marsilea, Lygodium, Pteris, Adiantum, Gleichenia, Cheilanthus, Blechnum, Acrostichum* 4P
4. Fossil Pteridophytes: Any eight forms (At least one from each group) 3P

Note: Collection and submission of any eight Pteridophytes and excursion report on studies of Pteridophytes from Western Ghat is compulsory. Submission of any five photographs of Pteridophytes form each group.

Gymnosperms

1. Study of external, internal and reproductive morphology of *Cycas* and *Zamia.* 2P
2. Study of external, internal and reproductive morphology of *Pinus, Cupressus, Araucaria*, *Agathis and Podocarpus.*(Any two) 3P
3. Study of external, internal and reproductive morphology of *Gnetum and Ephedra*. 3P
4. Study of fossil specimens of gymnosperm (any six) from order *Pteridospermales*, *Cycadeoidales* and *Pentoxylales***.** 4P

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PG Part 1 / M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP214 **Course Name : Practicals based on Biochemistry**

Teaching Scheme: PR: 8 Hours/Week **Credit 02**

Examination Scheme: CIA : 50 Marks **End-Sem : 25 Marks**

(12 Practicals)

1. Preparation of solution of different concentrations, buffers, conductivity and pH measurements. 1P
2. Enzyme assays- extraction and estimation of enzyme activity- Catalase amylase/lipase/peroxidase. 3P
3. Purification of enzyme by ammonium sulphate precipitation/gel filtration. 1P
4. Effect of pH and enzyme concentrations on enzyme activity. 2P
5. Effect of substrate concentration on rate of enzyme action and calculation of Km by Michalie's Menten Curve. 3P
6. Studies on induction of amylase activity by GA3 in germinating cereal grains. 2P
7. To perform colour test for carbohydrates (reducing and non-reducing sugars), lipids and proteins. 2 P
8. Isolation and estimation of chlorophylls and carotenoids. Separation of pigment using column chromatography. Determination of absorption spectra of each pigment. 2P
9. To separate amino acids by means of paper chromatography and TLC (thin layer chromatography) method. 2 P

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PG Part 1 M.Sc. (Botany) Sem II

(2023 Course under NEP 2020)

Course Code : 23ScBotP221 **Course Name : Genetics and Plant Breeding**

Teaching Scheme: TH:4 (Hours/Week) **Credit 04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisite Courses:

- A student should have a basic knowledge of genetics and plant breeding

Course Objectives:

- To study the mechanism of inheritance
- To understand the concept, methodology and applications of plant improvement

Course Outcomes:

On completion of the course, student will be able to–

- Work in seed industry as Technician and Assistant Plant Breeder

Course Contents

Unit 1	**Principles of mendelian inheritance and interaction of genes**	**6 Lectures**
	Introduction to genetics 1.1 Early concepts of inheritance 1.2 Mendel's Laws - Dominance, Segregation, Independent assortment, Chi Square test and probability 1.3 Interaction of genes- Complementary, epistasis, inhibitory, polymeric and additive 1.4 Chromosomal theory of inheritance Concept of gene, allele, multiple allele, pseudo allele- complementation tests.	
Unit 2	**Cytoplasmic inheritance:**	**3 Lectures**
	2.1 Mitochondrial and chloroplast genomes 2.2 Inheritance of chloroplast genes (*Mirabilis jalapa* and *Zea mays*) 2.3 Inheritance of mitochondria genes	

	(Petite yeasts, cytoplasmic male sterility in plants) 2.4 Interaction between nuclear and cytoplasmic genes Maternal effect in inheritance (*Limnaea peregra*).	
Unit 3	**Quantitative inheritance and Inheritance of complex traits**	**4 Lectures**
	3.1 Quantitative traits, Continuous variation 3.2 Inheritance of quantitative traits, (Polygenic traits) - corolla length in *Nicotiana*, cob length in *Zea mays* 3.3 Introduction to complex traits 3.4 Heritability and its measurement Marker assisted selection.	
Unit 4	**Population genetics**	**2 Lectures**
	4.1 Hardy Weinberg's Law 4.2 Factors affecting gene and gene frequencies	
Unit 5	**Recombination, linkage and mapping in eukaryotes**	**11 Lectures**
	5.1 Linkage and crossing over 5.2 Recombination: homologous and non-homologous, Inducing transposition site specific recombination 5.3 Genetic markers 5.4 Linkage maps, lod score for linkage testing, mapping by 3-point test cross Mapping by tetrad analysis in *Yeast* (unordered) and *Neurospora* (ordered)	
Unit 6	**Mutation**	**4 Lectures**
	6.1 Mutation- causes and detection 6.2 Types of Mutation- lethal, conditional, biochemical, loss and gain of function 6.3 Germinal v/s somatic mutants 6.4 Insertional mutagenesis 6.5 Point mutagenesis	
Unit 7	**Microbial genetics**	**3 Lectures**
	7.1 Methods of gene transfers- transformation, conjugation and transduction in bacteria and genetic recombination	

	7.2 Mapping of bacterial genome by interrupted mating Mutant phenotypes	
Unit 8	**Phage genetics**	**3 Lectures**
	8.1 Lytic and lysogenic cycles in phages 8.2 Genetic recombination- general and specialized transduction, site specific recombination in phage 8.3 Mapping the bacteriophage genome 8.4 Fine structure analysis of rII gene in T4 bacteriophage Phage mutants	
Unit 9	**Karyotype**	**2 Lectures**
	9.1 Structure and organization of chromosome, Concept of karyotype and idiogram 9.2 Chromosome banding 9.3 Preparation of chromosome for karyotype analysis 9.4 Karyotype evolution:Role of karyotype in identification of plant species	
Unit 10	**Numerical alterations of chromosomes**	**4 Lectures**
	10.1Concept of polyploidy 10.2Classification of polyoploidy, cytological and genetical method of identification of autopolyploids and allopolyploids 10.3Classification, method of production, identification and meiotic behavior of aneuploids (Monosomics, Nullisomics and trisomics)	
Unit 11	**Structural alterations of chromosomes**	**3 Lectures**
	11.1 Deletion, duplication, inversion, translocation, complex translocation heterozygotes 11.2Robertsonian 11.3BA translocations	
Unit 12	**Plant breeding**	**1 Lectures**
	12.1 Pre and post mendelian development 12.2 Objectives of plant breeding 12.3 Plant breeding in India Patterns of evolution in cultivated crops	

Unit 13	**Plant genetic resources**	**2 Lectures**
	13.1 Centers of origin, distribution and areas of diversity 13.2 Importance of genetic diversity in crop improvement and erosion of genetic diversity 13.3 Importance of genetic diversity in conservation and regulation.	
Unit 14	**Reproductive systems, population structure and breeding strategies**	**2 Lectures**
	14.1 Sexual reproduction (Cross and self-pollination) 14.2 Asexual reproduction 14.3 Pollination control mechanisms and implications of reproductive system on population structures 14.4 Genetic structure of populations	
Unit 15	**Selection methods**	**4 Lecture**
	15.1 Selection methods in self-pollinated crops 15.2 Selection methods in cross pollinated Crops 15.3 Selection methods in asexually propagated crops	
Unit 16	**Hybridization**	**3 Lectures**
	16.1 Hybridization and its role 16.2 Inter-varietal and wide/distant crosses Principles of combination breeding and its application	
Unit 17	**Induced mutations in crop plants**	**3 Lectures**
	17. 1 Physical and chemical mutagens used for induction of mutations, chimeras 17.2 General method of induction of mutations in crop plants 17.3Role of induced mutations 17.4 Induction of polyploidy in crop plants Role of polyploidy in plant breeding	

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Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

PG Part 1 Year of M.Sc. (Botany)

(2023 Course under NEP 2020)

Course Code : 23ScBotP222 Course Name : Molecular Biology

Teaching Scheme: TH: Hours/Week **Credit :04**

Examination Scheme: CIA : 50 Marks **End-Sem : 50 Marks**

Prerequisite Courses:

- A student should have a basic knowledge of molecular biology

Course Objectives:

- To study the theoretical concepts and experimental techniques of molecular biology.
- To learn mechanism of prokaryotic and eukaryotic mechanisms of storage, retrieval and manipulation of genetic information.

Course Outcomes:

On completion of the course, student will be able to–

- Understand molecular biology of prokaryotic and eukaryotic organisms.
- Understand the mechanisms and need of regulation of gene expression

Course Contents

Unit 1	Structure and properties of nucleic acids	Lectures
	1.1 Chemical and physical structures of nucleic acids 1.2 Spectroscopic and thermal properties of nucleic acids. (e.g. Buoyant density, melting temperature, effect of acid and alkali, UV absorption, hypo and hyperchromicity) 1.3 Dissociation and reassociation kinetics of DNA 1.4 C-value paradox	

	1.5 Cot curves, Cot ½ values and their significance 1.6 Unique, moderately repetitive and highly repetitive DNA 1.7 Forms of DNA. (A, B, C, Z) 1.8 RNA as a genetic material	
Unit 2	**Organisation of genetic material**	**2 Lectures**
	2.1 Packaging of genome in viruses and bacteria 2.2 Organelle genome organization Structure of chromatin, nucleosome packaging, histone modification, chromosome organisation	
Unit 3	**DNA replication**	**4 Lectures**
	3.1 Mechanism of prokaryotic and eukaryotic DNA replication, replication apparatus 3.2 Origins of replication, priming and DNA polymerases 3.3 Models for mechanism of replication for circular DNA: Rolling circle and theta (Ø) models 3.4 Fidelity of replication 3.5 Extrachromosomal replications, DNA modification and DNA restriction	
Unit 4	**DNA damage and repair**	**3 Lectures**
	4.1 Types of DNA damage 4.2 Enzymes involving in repairing of DNA damages 4.3 Type of DNA repair 4.4 Photoactivation, excision repair, recombination repair and mismatch repair systems, SOS repair	
Unit 5	**Gene structure**	**5 Lectures**
	5.1 Structure and organization of prokaryotic and eukaryotic genes 5.2 Structure and role of promoters, exons, introns, terminators and enhancers.	
Unit 6	**Transcription**	**5 Lectures**
	6.1 RNA polymerases and their role 6.2 Transcription apparatus 6.3 Transcription in prokaryotes and	

	eukaryotes- Initiation, elongation and termination	
Unit 7	**Processing of RNA**	**5 Lectures**
	7.1 Processing of tRNA, rRNA, RNA editing, capping, methylation, polyadenation and splicing 7.2 Ribonucleoproteins 7.3 Structure of mRNA- RNA transcript, RNA damage and RNA repair	
Unit 8	**Protein synthesis**	**6 Lectures**
	8.1 Structure of mRNA, rRNA, tRNA and ribosomal assembly 8.2 Mechanism of protein synthesis in prokaryotes and eukaryotes: initiation, elongation and termination 8.3 Translational and post translational control	
Unit 9	**Post translational modifications of proteins**	**6 Lectures**
	9.1 Targeting of organelle proteins 9.2 Protein folding and processing Chaperones and chaperonins	
Unit 10	**Regulation of gene expression**	**3 Lectures**
	10.1Operon concept (Lac, Tryptophan, Arabinose) 10.2 Positive and negative regulation of prokaryotic genes 10.3 Role of eukaryotic transcription factors	
Unit 11	**Techniques used in molecular biology**	**8 Lectures**
	11.1RT Polymerase Chain Reaction 11.2 Blotting techniques 11.3 Mass-spectrometry	
Unit 12	**Promotor characterization**	**5 Lectures**
	12.1Promotor analysis through reporter genes 12.2 Electrophoretic mobility shift assay DNA foot-printing	

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