Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Shelar P.D Department: Botany

Program: MS.c FY Subject: Botany Course Code: SBOTC401

Paper Title: Diversity of microbes

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	Bacteria	General charectors,Classification based on Bergey's manual, ultrastructure, types, Structure of Endospore, Nutrition (Autotrophic, Heterotrophic and Symbiotic) Reproduction: Binary fission, Transformation, Transduction and Conjugation. Differential staining of bacteria -Gram Staining . Symptoms of Bacterial Diseases of Plants, Bacterial Diseases: Citrus canker,Black arm of cotton and soft rot of Potato.Economic importance of Bacteria .	1. Understand the morphology , structure and importance of the various organism. 2.diffrentiate between various groups of fungi, Bacteria, Viruses,and Lichens &Mycorrhiza. 3.lean the life cycles of individuals belonging to fungi, Bacteria, viruses,Lichens & Mycorrhiza.
II	Viruses and Mycoplasma	Viruses: General charectors, classification, Chemical composition, Ultrastructure of Plant viruses (TMV),	1. Understand the morphology , structure and

		Multiplication, Transmission of plant viruses and Symptoms of viral diseases of plants. Viral Diseases: Bean mosaic virus,Leaf curl of Papaya and yellow vein mosaic of bhendi. Economic importance of viruses. Mycoplasma: General charectors, ultra structure, symptoms of Mycoplasmal diseases of plants Mycoplasmal diseases: Grassy shoot disease,Sessamum phyllody and little leaf of brinjal. Economic importance of Mycoplasma.	importance of the various organism. 2.diffrentiate between various groups of fungi, Bacteria, Viruses,and Lichens &Mycorrhiza. 3.lean the life cycles of individuals belonging to fungi, Bacteria, viruses,Lichens & Mycorrhiza.
III	Introductory Mycology	Fungi: General charectors, classification (As per Ainsworth,1973ml,Alexopoulos and Mins,1979), Ultrastructure of fungal cell,Thallus organization, Nutrition and reproduction(Asexual and Sexual) . Life cycle pattern and phylogeny of different fungal groups - Gymnomycota,Mastigomycota and Amastigomycota : Zygomycotina, Ascomycotina ,Basidiomycotina And Deteuromycotina. Fungal Disease: Early Blight of tomato ,Downy mildew of grape and yellow rust of wheat.	1. Understand the morphology , structure and importance of the various organism. 2.diffrentiate between various groups of fungi, Bacteria, Viruses,and Lichens &Mycorrhiza. 3.lean the life cycles of individuals belonging to fungi, Bacteria, viruses,Lichens & Mycorrhiza.
IV	Applied Mycology	Fungi as food and feeds: Mushroom _Types, cultivation, nutritional and medicinal value. Role of fungi in food processing, industry, medicine, agriculture, biological control	1. Understand the morphology , structure and importance of the various organism. 2.diffrentiate between various groups of fungi,

		of pests and fungi as bio fertilizers Mycorrhizae Types (Ecto and endo). formation of mycorrhizae association with plants.	Bacteria, Viruses,and Lichens &Mycorrhiza. 3.lean the life cycles of individuals belonging to fungi, Bacteria, viruses,Lichens & Mycorrhiza.

Course outcomes:

1. Understand the morphology , structure and importance of the various organism.

2.diffrentiate between various groups of fungi, Bacteria, Viruses,and Lichens &Mycorrhiza.

3.lean the life cycles of individuals belonging to fungi, Bacteria, viruses,Lichens & Mycorrhiza.

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Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Lahane S. S Department: Botany

Program: Msc Fy Subject: Botany Course Code: SBOTC402

Paper Title: Diversity Of Cryptogames

Unit Number	Unit Name	Topics:- Algae-I	Unit-wise Outcome
I	UNIT I	Introduction, General characters and classification of algae as per F. E. Fritsch(1944) and G. M. Smit h(1955) , Thallus organization, Habitat(terrestrial, fresh water, marine) and ultrastructure of algal cell, pigments, reserve food, types of flagella in algae, and algal blooms. Reproduction in algae(Vegetative asexual, and sexual). Algal culture, Cultivation of spirulin and SCP.	Understand the morphology, structure and importance of the organisms.
II	UNIT II	General morphology, reproduction and phylogenetic consideration of Cyanophyta, Chlorophyta and Charophyta. General morphology, reproduction and phylogenetic consideration of Xanthophyta and	Differentiate between various groups of Algae, Bryophytes and Pteridophytes.

		chrysophyta General morphology, reproduction and phylogenetic consideration of Phaeophyta and Rhodophyta. Economic importance of algae.	
III	UNIT III	**Bryophyta** **Introduction:-Habitat, habit, distribution and outline of classification as per Smith(1955) and Proskauer(1957).** **Thallus organization:internal structure and reproduction in Marchantiales, Anthocerotales, Sphagnales and Funariales.** **Structure and evolution of gametophytes and sporophytes in Bryophytes.** **Economic importance of Bryophytes.**	**Leran the life cycles of individual belonging to Algae, Bryophytes and Pteridophytes.**
IV	UNIT IV	Pteridophyta General characters and classification (based on the classification proposed by Smith, 1955; Bold, 1958 and Zimmermann, 1959). Morphology, anatomy and reproduction kn Psilotales, Lycopodiales, Equisetales, Filicales, and Marsileales. Stelar organization and evolution in Pteridophytes. Heterospiry and seed habit, Geological Time Scale and Fossilization process. Economic importance of Pteridophytes.	

Specify Course Outcome:

1. Understand the morphology, structure and importance of various organisms.
2.Differentiate between various groups of Algae, Bryophytes and Pteridophytes
3.Learn the life cycles of individuals belonging to Algae, Bryophytes and Pteridophytes.

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College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Shelar P.D Department: Botany

Program: MSc FY Subject:Botany Course Code: SBOTC403

Paper Title: Taxonomy of Anglosperms and Gymnosperms

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	General characters and classification Gymnosperms as proposed by Professor Birbal Sahni (1920), Sporne (1965), S.P. Bhatnagar and Alok Moitra (1996). Comparative account of sporophyte and gametophyte of Cycadales, Ginkgoales, Coniferales and Gnetales.General account of Pteridospermales, Pentoxylales and Cordiatales. Economic importance of Gymnosperms. Palaeobotany: Principles of palaeobotany, Fossilization: Process, types, methods of preservation. Geological time scale and importance of fossil plants.	1. Understand the morphology, structure and Importance of the various organisms. 2. Differentiate between various groups of Gymnosperms, Angiosperms and fossil plants. 3. Learn the characters of taxa belonging to Gymnosperms, Angiosperms and fossil plants.
II	UNIT II	Aims and Principles of	1. Understand the

		taxonomy, taxonomic structure. Origin of Angiosperms: Theories, cradle of angiosperms, abominable mystery, Continental drift theory. Plant Speciation: Allopathic, Abrupt, Sympatric, Hybrid, Apomictic speciation, Isolating mechanisms. Concept of species: Typological, Evolutionary and Biological. International Code of Nomenclature for algae, fungi and plants (ICNafp): Salient features, Principles, Important Rules and Recommendations, Provisions, Appendices	morphology, structure and importance of the various organisms. 2. Differentiate between various groups of Gymnosperms, Angiosperms and fossil plants. 3. Learn the characters of taxa belonging to Gymnosperms, Angiosperms and fossil plants.
III	UNIT III	Comparative account of various systems of classification of angiosperms proposed by Linnaeus, Bentham and Hooker, Engler and Prantl, Cronquist and APG-IV system. Study of comparative account of following Angiospermic families_Magnoliaceae, Annonaceae, Rosaceae, Malvaceae, Aplaceae and Apocynaceae, Study of comparative account of following Angiospermic families-Verbenaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Asteraceae, Nyctaginaceae, and Euphorbiaceae Study of comparative account of following Angiospermic families-Poaceae, Cannaceae and Orchidaceae.	D1. Understand the morphology, structure and importance of the various organisms. 2. Differentiate between various groups of Gymnosperms, Angiosperms and fossil plants. 3. Learn the characters of taxa belonging to Gymnosperms, Angiosperms and fossil plants.
IV	UNIT IV	1	1. Understand the

		Taxonomic evidences and techniques used in- Chemotaxonomy: Origin of chemotaxonomy, classes of compounds and their taxonomical significance, techniques Numerical taxonomy: Principles, Operational taxonomic Units (OTU), construction of taxonomic groups, cluster analysis and applications. Molecular Systematics: Molecular techniques, restriction fragment length polymorphism (RFLP's), Random amplified polymorphic DNA (RAPD) Applications of molecular systematics. Biosystematics: steps, categories and importance of bio systematic studies	morphology, structure and importance of the various organisms. 2. Differentiate between various groups of Gymnosperms, Angiosperms and fossil plants. 3. Learn the characters of taxa belonging to Gymnosperms, Angiosperms and fossil plants.

Specify Course Outcome: outcomes:

1. Understand the morphology, structure and importance of the various organisms.

2. Differentiate between various groups of Gymnosperms, Angiosperms and fossil plants.

3. Learn the characters of taxa belonging to Gymnosperms, Angiosperms and fossil plants.

Signature of Teacher

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami **Department: Botany**

Program:Msc F. Y **Subject**: Botany **Course Code**: SBOTE401

Paper Title: Bioinstrumentation & methods in biology

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Introduction:Safe use of laboratory equipments, personal protection, Hazardous and waste disposal. **Microscopy_ working & application of simple, compound. Phase contrast & fluorescence microscope Scanning & transmission electron microscope. Micrometry, flow cytometry, microtomy block designing fixation, cutting & staining.**	Understand the actual working & application of different laboratory equipments.
II	UNIT II	Principle & application of paper chromatography,thin layer & column chromatography. Principle & application of gel filtration,ion exchange,affinity,gas,HPLC, HPTLC. Principles & working and application of laminar air	**Learn the various techniques used in life sciences and their utility.**

		flow, autoclave,hot air. Principles,working & application of oven, incubator,ph meter,sterilization by filtration method.	
III	UNIT III	**Beer_Lambert's law, principles & techniques of calorimeter & uv visible spectrophotometer. NMR, atomic absorption spectrometry & plasma emission spectroscopy. X_ ray diffraction, Radioactive isotopes, autoradiography, effect of radiations on biological systems, units of radioactivity, use of radioisotopes, detection & measurement techniques. Liquid scintillation counting solid state, geiger counter.**	
IV	UNIT IV	Electrophoresis: principal & application, types_ paper, gel agarose, PAGE, pulsed field, capillary, isoelecric focusing, 2D electrophoresis, RFLP, RAPD & AFLP techniques. Blotting techniques: western, southern, northern, methods & application in life sciences Cetrifugation: principle & application of cetrifugation techniques, Designs of rotors, bench top, low speed, high speed, cooling, ultracentrifuge.	

Specify Course Outcome:

1. Understand the actual working & application of different laboratory equipments.

2. Learn the various techniques used in life sciences & their utility.

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Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami Department: Botany

Program: Msc F. Y Subject:Botany Course Code: -SVECR401

Paper Title: Research methology

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Introduction, Meaning, importance, aims & objective of research, identification & criteria of selecting research problem (hypothesis) literature collection, Research plan & it's components. Methology (Experimetal design /field data collection, Data presentation & interpretation, Drawing conclusions. Hypothesis_ Different types_significance _ Development of working hypothesis, Null hypothesis. Research methods: scientific methodvs arbitray method, logical scientific method, deductive_ inductive deductive_ inductive pattern of deductive_ inductive logical process. Different types of inductive logical methods.	Develop the ability to apply the methods while working on research project work.

4			Post Inflectional Structural defence in host plants: Formation of Cork layer, Tyloses, Abscission layers, Gum deposition, Sheathing of hyphae.Biochemical Defence: Pre existing biochemical defence: Antifungal and antimicrobial compounds released by the plant in its environment, Inhibitors already present in plant cells, Deficiency of essential nutrients for growth of pathogen.Post infectional Biochemical Defence: Defence through detoxification of pathogen toxins, Defence through induced synthesis of proteins and enzymes, Defence through hypersensitivity, Toxic chemicals produced in plant in response to infection. Phytoalexins: Synthesis, Characteristics and role.	method of disease management,use of biological and chemical in disease management. 2.Students will known symptoms, etiology, disease cycle and management of major disease of cereals, pulses,oil and vegetables.
5	IV	UNIT IV	Bases of disease management principles, Avoidance of the pathogen, exclusion of pathogen, plant quarantines, Eradication of the pathogen, Protective measures.Disease Management Practices: Cultural practices for disease management, production and use of disease free propagating materials.Disease management through toxic chemicals: Chemical nature, classification and action of Sulphur fungicides, copper fungicides, mercury fungicides, systemic	1.Student will known importance of sign and symptoms for detection of pathogens and disease, integrated method of disease management,use of biological and chemical in disease management. 2.Students will known symptoms, etiology, disease cycle and management of major disease of cereals, pulses,oil and vegetables.

		paper using TEMPLATE Calculations of impact factors of journal, citation index, ISBN & ISSN. Preparation of project proposal title, abstract. Introducion_Rationale objectives, methology_time frame & work plan_ budget & justification references. Documentation & scientific writing results & conclusions preparation of manuscript for publication of research paper, presenting a paper in scientific seminar. Thesis writing, structure & components of research reports, types of report research papers, thesis research project reports, pictures & graphs, citation styles writing a review of paper. Bibliography	

Specify Course Outcome:

1.Develop the ability to apply the method while working on research paper.

2.Develop a appropriate framework for research studies.

Signature of Teacher

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Lahane Shital S. Department: Botany

Program: Msc FY Subject: Botany Course Code: SBOTC451

Paper Title:- Cell Biology, Genetics and Plant Breeding

Unit Number	Unit Name	Topics	Unit-wise Outcome		
I	UNIT I	Structure and function of prokaryotic and eukaryotic cells,structural organization and function of cell wall,Mitochondria, Vacuoles,Chloroplast,ER,Golgi Complex and Nucleus, Structure and function of cytoskeleton. Chromosome- Structure and function; Heterochromatin and Euchromatin. Karyotype. Cell division and cell cycle - Mitosis, Meiosis, regulation and control of cell cycle. Membrane Structure and function- lipid bilateral and Membrane protein.Cell signaling and cell receptors, G -protein Coupled Receptors,signal transduction.	Understand the structural organization and functions of cell organelles.		
II	UNIT II	Introduction to pre Mendelian,Mendelian and	Able to understandGene Structure, linkage		

		Post Mendelian genetics Gene Interaction and Epistasis Linkage and Crossing over.Sex linked inheritance (characters, cause and linkage in human and other organisms). Sex determination (chromosomal),dosage compensation, characters of multiple alleles; examples: A,B,AB and O blood groups in humans ,Rh factors.	grou,Genetic inheritanceand, extra chromosomalinheritancein plants..		
III	UNIT III	Genetics-II Gene Structure and regulation of gene expression in prokaryotic and eukaryotic, C-value paradox. Cytoplasmic inheritance (Mitochondria and Plastid). Chromosomal aberrations (Structural and Numerical) Population Genetics (Gene and genotype frequency, Hardy Weinberg law), Gene pool,factors affecting Gene frequency (Selection, Mutation, Migration and Genetic Drift)	Understand basic techniques of hybridization.		
IV	UNIT IV	Plant Breeding Breeding methods in crop plants (self and cross pollinated crops) Sexual reproduction (cross and self pollination), Asexual reproduction. Incompatibility and male sterility, their types,mechanisms and applications in plant breeding. Hybridization (types,procedure and its importance) Heterosis(definition, Genetic basis and methods of estimation).Mutation Breeding (types and role in plant breeding).			

Specify Course Outcome:

1.Understamd the Structural organization and functions of cell organelles.
2. Able to understand Gene Structure, Linkage groups, Genetics inheritance,and extra chromosomal inheritance.

3.Understand basic techniques of Hybridization.

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami **Department: Botany**

Program: Msc F.y **Subject**: Botany **Course Code**: SBOTC452

Paper Title: plant resource utilization & biodiversity conservation.

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Domestication & introduction of plants, origin of cultivated plants, vavilox's centers of origin. Plant as source of food, fodder, fiber, spices, beverages, edible oils, drugs, narcotics, timber, gums, resins, dyes & latex. Medicinal & Aromatic plants. Plants as source of renewable energy. Role of biotechnology In agriculture, medicine, industry & green house technology.	The know the economic importance of plant wealth. .
II	UNIT II	.Biodiversity:Concept of biodiversity:Species diversity, Genetic diversity, Ecosystem diversity. Origin, values & threats to biodiversity biodiversity & agriculture, biodiversity &	**To know principles & strategies of biodiversity & it's conservation.**

		conservation_chipko movement, river dam & tribal compaign. Role of universities & other biodiversity conservation. Role of BSI, NBPGR, ICAR, CSIR, & Development of biotechnologies in sustainable development.	

Specify Course Outcome:

1. Study of origin, cultivation & economic importance of various plant wealth.
2. Learn the importance of biodiversity & motivation of students for its conservation.

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Signature of Teacher

		food diversity. Bioprospecting. Diversity in India, endemic concept & types, endemic & endangered species of india. Hot spot _ Global & indian, IUCN categories, Red data book, convention on biological diversity (CBD)	
III	UNIT III	Conservation_1:Green revolution_benefits & adverse consequences, principles of conservation. Major approaches to conservation & current practices in conservation of genetic diversity, species diversity, ecosystem diversity. Conservation strategies_in situ conservation, project tiger, biosphere reserves & sanctuaries. Conservation strategies:National parks, mangroves, on_ farm & home garden conservation.	To study role of various organization in sustainable development.
IV	UNIT IV	Conservative 2: conservation strategies_Ex-situ conservation, principles & practises, germ plasm collections, botanic gardens, seed banks, test tube gene banks, pollen banks, cryobank, ex-situ conservation of microbes. Social approaches to conservation_sacred groves , sthala vrikshas. People movement for biodiversity	Importance of biodiversity conservation.

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Shelar P.D Department: Botany

Program: MSc FY Subject: Computer Science Course Code: SBOTE 451

Paper Title: Plant Ecology, Environmental biology and Photography

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Introduction- Scope and importance of ecology in India, Ecological tools and techniques, Sampling techniques of population, methods of estimating primary production and consumer production. Ecosystems - Concepts of ecosystem, Function of Ecosystem – Energy flow and Mineral cycling (C, N,P),	Able to understand the ecological principles, structure and functions of ecosystem. 2. Learn about the causes of environmental pollution and its control measures. 3. Learn about different phytogeographic regions and their vegetation pattern.
II	UNIT II	Characterization of a population, population	Able to understand the ecological

		growth curves, population regulation, life history strategies (Y and K selection), Concepts of metapopulation - demes and dispersal, interdemic extinctions, age structured populations. Community ecology- Nature of communities, community structure, levels of species diversity and its measurement, edges and ecotones. Ecological succession – Types, mechanisms, change, involved in succession, concept of climax	principles, structure and functions of ecosystem. 2. Learn about the causes of environmental pollution and its control measures. 3. Learn about different phytogeographic regions and their vegetation pattern.
III	UNIT III	The Environment – Physical and biotic environment, biotic and abiotic interactions. Environmental pollution – Causes, effects and control measures of air, water, soil and thermal pollution, Nuclear hazards, phytoremediation, Global warming and climate change, acid rains, ozone layer, ozone hole. Social issues and the environment – EPA 1986, Urban problems related to energy, water conservation, rain water harvesting, environmental ethics, issues and possible solutions.	Able to understand the ecological principles, structure and functions of ecosystem. 2. Learn about the causes of environmental pollution and its control measures. 3. Learn about different phytogeographic regions and their vegetation pattern.
IV	UNIT IV	Phytogeography: introduction, Botanical provinces of India and their characteristic vegetation.Forest types of India. Ecological importance of forests, aforestation,	Able to understand the ecological principles, structure and functions of ecosystem. 2. Learn about the

		deforestation, social forestryGeographical history, Continental Drift, Land Bridges, shifting of poles. Theories of differentiation and natural selection, types and areas of natural distribution and theory of tolerance.	causes of environmental pollution and its control measures. 3. Learn about different phytogeographic regions and their vegetation pattern.

Specify Course Outcome:

Able to understand the ecological principles, structure and functions of ecosystem.

2. Learn about the causes of environmental pollution and its control measures.

3. Learn about different phytogeographic regions and their vegetation pattern.

Signature of Teacher

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami **Department:** Botany

Program: MSc 2 yr **Subject**: Botany **Course Code**:11

Paper Title: XI: PLANT PHYSIOLOGY

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Introduction: Scope and Importance of Plant Physiology; Bioenergetics- concept of free energy, enthalpy, entropy, basic laws of thermodynamics; Molecular Structure and Physico chemical properties of water, Solutions, Suspensions, Colloidal System, Diffusion, Osmosis, Imbibitions, Concept of Water Potential, Water absorption, Transportation, Transpiration. Uniport, Symport, Antiport channels, Phloem transports across the plant, Mechanism of Phloem Loading and Unloading source and sink relationship. Brief Account on Macro and Micronutrient, Functions and deficiency and symptoms of different Macro and Microelements.	Understanding the mechanism of different wate based process in plants.
II	UNIT II	Phytochromes- Introduction,	To understand role of

		discovery and properties of Phytochromes, red and far red pigment system; Effect of Phytochromes on plant development; Phenomenon of Photoperiodism and Vernalization. Causes and methods of breaking seed dormancy Hormonal Physiology: Biochemistry,Mode of actions, Mechanism of biosynthesis and Practical applications of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene, Brassinosteroides, Salicylic acid Jasmonic Acid. Role of hormone in fruit ripening, biochemical and molecular changes during ripening. Plant Movement: Introduction and types of spontaneous and induced plants movement.	light and hormones in plant.
III	UNIT III	Photochemistry: Nature and Properties of light, fluorescence, phosphoresce, quantum requirement and quantum yield, Ultra structure of chloroplast, Location and organization of photosynthetic pigments, Chemistry, properties and biosynthesis of photosynthetic pigments, Mechanism of light capturing and light harvesting. Photosynthesis: Van niel Hill Reaction, two pigment system, water oxidation complex, electron transport system - Z – scheme, cyclic, non cyclic, photophosphorylation and ATP synthesis, photosynthetic carbon	To know process of food synthesis in plants.

		reduction pathways in C3, C4 and CAM plants, Biochemical variants of C4 pathway. Regulation of Calvin Cycle, Biochemistry and Genetics of RUBISCO. Photorespiration and its significance, inhibitors and uncouples of photosynthesis.	
IV	UNIT IV	Cell Respiration: Introduction to plant respiration, respiration types and locations, fermentations and its types, Mitochondrial anatomy, concept of RQ, Glycolysis: Mechanism and regulation ,entry of pyruvate to Mitochondria, pyruvate dehydrogenase, formation of acetyl co-a, Kerb's cycle: Mechanism, regulation and significance, Anapleorotic reactions of TCA, Electron transport system and oxidative phosphorylation, mechanism and regulation of ATP synthesis. Pentose Phosphate Pathway and its significance, Glyoxalate pathway, Energetics of fermentation and respiration, Factors affecting on respiration Respiratory, inhibitors and uncouplers of respiration.	To know process of food breakdown in plants.

Specify Course Outcome:

1. Understanding the mechanism of different wate based process in plants.
2. Able to understand role of light, hormone in controlling plant activity.
3. Understand important plant process i.e. photosynthesis and respiration.

Specify Program Outcome:

1. To understand basic aspects plant life processes.

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College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami Department: Botany

Program: Msc S. Y Subject: botany Course Code: 17

Paper Title: Biotechnology & genetic engineering

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	.Biotechnology_1: Scope & importance, history of plant tissue culture, cellular differentiation & totipotency, culture media, aseptic culture technique. Organogenesis: Techniques & utility of organogenesis, callus culture, characteristics of organogenesis, factor affecting organogenesis. Micropropagation:Explant used in micropropagation, stages in micropropagation. Advantages & disadvantages of micropropagation. Somoclonal variations : introduction & application of somoclonal variations. Somatic embryogenesis: introduction, principle importance of somatic embryogenesis, factor affecting & practical	Understanding basic principles & techniques of tissue culture.

		applications.	
II	UNIT II	.Biotechnology-2: protoplast culture: introduction, method & application of protoplast culture. Somatic hybridization:protoplast fusion, PEG Treatment, regeneration of hybrid plants & application. Synthetic seeds: Method for making artificial seeds & their application. Haploid culture: anther, pollen & ovule culture, application of anther & microspors culture merits & demerits & application of ovule culture. Application of plant tissue culture: production of disease resistant plant, embryo culture production of secondary metabolites & germplasm storage	Large scale industrial applications of plant tissue culture.
III	UNIT III	Genetic engineering:techniques in molecular gemetics, basic techniques, restriction digestion , production of recombinant DNA molecules, amplification using vectors, construction of genomic libraries cDna libraries & screening Dna libraries for genes of intrest. The manipulation of cloned dna sequence, in vitro using phagmid vectors, in vitro site specific mutagensis, molecular analysis of genes & chromosomes; PCR, physical maps of DNA molecules based on RFLP & Fine structure maps, regulations of expression, gemome sequencing strategies & programe, methods of sequencing, microarrays & their applications; gene tagging ;	Able to understand technique & process of clone.

		gene & promoter trapping, knockout & knock down mutants	
IV	UNIT IV	r-DNA Technology: Restriction & nucleic acid modifying enzymes, restriction mapping, vectors in gene cloning & their choice;plasmids, phages, cosmids, plant viruses, synthetic DNA vectors; isolation of specific genes from bacteria & higher plants; cloning;genome sequencing tagging; gene & promoter trapping; knockout & knock_down mutants, comparative genomics of model plants & related crop species ; RNA & gene silencing, genome imprinting, small RNAs & their biogenesis, role of small RNAs in heterochromatin formation & gene silencing.	To understand technique & basic of molecular genetic & recombinant Dna.

Specify Course Outcome:

1. Understand technique & process of tissue culture.
2. Large scale industrial applications of plant tissue culture

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Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami **Department:** Botany

Program: Msc SY **Subject**: Botany **Course Code**: 19

Paper Title: Phytochemistry & pharmacognosy

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Pytochemistry_1:Breif outline of occurrence, distribution & synthesis, chemistry & biological activity of major secondary metabolites Alkaloids, flavanoids, simple phenolics, glycosides, tannins, anthroquinones, saponins, steroids, pigments(anthocyanin & betacyanin), Resins, gums & volatile oils. Methods of extraction, isolation, purification, identification & estimation of secondary metabolites.	Understand the concept of drug adulteration.
II	UNIT II	.Phytochemistry2: phytochemistry in relation to taxonomy. Proteins & taxonomy: seed proteins, analysis of aminoacid sequence & it's significance in systemstic. Serology and taxomomy: history, precipitation reaction,	Learn the pharmacognostical aspects of common drug plant

		techniques, application of serological data in plant systemarics. Ethnobotany: concept & classification. Methods & techniques used in ethnobotany. Floristic diversity & medicinal plant research scenarionin Maharashtra.	
III	UNIT III	Pharmacognosy_1: History, definition & scope, classification of crude drugs : taxonomical, morphological chemical & pharmacological (therapeutic) , classification, method of cultivation, harvesting, drying & storage of drug plants. Quality control as herbal drugs: drug adulteration & their types, detection of adulterants byorganoleptic & microscopic methods.	Understand the knowledge of important medicinal plants
IV	UNIT IV	Pharmocognosy2: pharmacognostic studies (Nomenclature, morphology, anatomy, chemistry, uses & adulterants) of following drug plants. 1. Root drugs: Asparagus, withania 2. Rhizome drugs:zingiber, curcuma. 3. Bark drugs:Acacia, cassia 4. Leaf drug:Adathoda, vitex	To know the characters & cultivation practices of herbal drugs

Specify Course Outcome:

1.Understand the concept of drug adulteration.

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Fareha Azami **Department:** Botany

Program: MSc 2 yr **Subject**: Botany **Course Code**:14

Paper Title: -XIV: ANGIOSPERMS-II

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Theories of Organization of Root Apical Meristem (RAM) and Shoot Apical Meristem (SAM): Apical cell theory, Tunica corpus theory,Histogen theory, Korper Kappe theory. Cytological and molecular analysis of SAM. Root: Development of adventitious roots, Lateral roots and Root hairs, Primary and Secondary growth of root (Monocot and Dicot). Concept of Quiescent centre, Cell fates and lineages,	To know the internal organization of root and shoot
II	UNIT II	Development, differentiation and Histology of Monocot and Dicot leaf; Anatomy of node and its significance; Leaf venation pattern; Types of stomata and trichomes; Secretary Tissues and laticifers. Wood Anatomy: Hard wood and sap wood, porous & non porous wood,	To understand the development and differentiation of various plant parts

		distribution and types of wood parenchyma. Vascular tissue differentiation related to xylem and phloem. Vascular anatomy of flower. General account of anatomy of fruit and Seed.	
III	UNIT III	Means of reproduction in flowering plants, Anther structure: Biochemical and Ultra structural aspects, structure and function of tapetum, Microsporogenesis, pollen tetrad development and types, pollen wall morphogenesis, biochemical, physiological and genetic events involved in pollen development. Ultra structure of Pollen morphology, pollen wall sculpturing, NPC classification. Pollen viability. Male sterility: genetic and cytoplasmic male sterility	To study and impart the knowledge of anatomy and reproductive biology of angiosperms
IV	UNIT IV	Pistil: Structure and function of stigma and style. Types of stigma, stigma receptivity and its importance, biochemical aspects. Stylar tissue. Types of Pollination mechanism, Pollen-pistil interaction. Sporophytic and Gametophytic self-incompatibility. Incompatibility and its significance. Pollen adhesion and germination on stigma, pollen tube development. Megasporogenesis, Types of ovules, ovule development and structure, embryo sac development and structure. Double fertilization and triple	2. Learn the basic and applied embryological aspects of angiosperms

		fusion, development of embryo, endosperm and seed. Dynamics of fruit growth, biology of fruit maturation.	

Specify Course Outcome:

1. To know the internal organization of root and shoot
2. To understand the development and differentiation of various plant parts
3. To study and impart the knowledge of anatomy and reproductive biology of angiosperms

Specify Program Outcome:

1. Understand the organization of Root and Stem Apical Meristem
2. Learn the basic and applied embryological aspects of angiosperms

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Lahane S.S Department: Botany

Program: M.sc Sy Subject: Botany Course Code: XIII A

Paper Title: Principles of Plant Pathology-I

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Fundamentals of Plant Pathology. Scope and importance of Plant Pathology:Worldwide development of Plant Pathology as a profession, Careers in Plant Pathology, The Practice and Practioners of plant pathology, plant disease Clinics, Relationship of Plant Pathology with other sciences,certifications of professional plant pathologists,Innovations in teaching Plant Pathology. Contribution of scientists in the field of Plant Pathology:Anton de Bary, E.F.Smith, E.C.Stakman, E.J.Butler, C.V.Subramanian, M.J.Thirumalachar, Prof.T.S.Sadasivan, Survival of Plant Pathogens:Infection chains, Major factors affecting the Survival of Pathogens in soil, Major sources of survival, Dormancy, survival of fungal Pathogens, phytopathogenic bacteria, nematodes and Plant viruses.	The Students will able to understand the importance of plant pathology and will helps to develop interest in plant pathology.
II	UNIT II	IThe pathogenesis	They will bring the

		role. Pectolytic Enzymes:- types,mode of action and role of pectolytic Enzymes in pathogenesis. Macerating Enzymes, general account of hemicelluloses,lignolytic Enzymes, proteolytic Enzymes and lipolytic Enzymes. Toxins in pathogenesis:- classification of toxins- pathotoxins,vivotoxins,and phytotoxins,chemical nature and mode of action of Victorin ,Lycomarasmin,Fusaric acid,Wild fire toxin,General account of pyricularin, alternative acid and cercosporin,effect of toxin on plant tissues,general account of Aflatoxin.	of plant pathogens.
III	UNIT III	Genetics and Biotechnology in relation to Plant Pathology. Genetic Variability in plant pathogens:genetic Variability in bacteria, viruses and fungi. Mechanism of Variability in plant pathogens- Hybridization, Mutation and cytoplasmic inheritance. Genetics of host parasitic interaction-evolution of parasitism ,resistance and susceptibility, Gene for gene relationships. Types of plant resistance:- Horizontal and vertical resistance in the host,loss of virulence in plant pathogens, Physiological specialization and production of new races. Biotechnology in relation to plant pathology:- role of Biotechnology in plant disease management,	They will understand how resistance varieties are developed against different pathogens.

		development of disease free plants by meristem tip culture.	
IV	UNIT IV	Molecular plant pathology. Introduction of molecular plant pathology. Molecular diagnostic:- Identification of Pathogens by molecular techniques: Southern, Northern and western hybridization. PCR based method. Molecular biology of plant pathogens: gene clonning- properties of good clonning vectors, vectors for gene clowning in plants (Ti plasmid). Restriction Enzymes:- classification of restriction endonucleases and applications. Molecular markers in pathogen populations:- properties of molecular markers, Types of DNA markers(,RFLP and RAPD markers), Applications of molecular markers. Transgenic plant disease management:-strategies for development of Transgenic: methods of gene transfer, genetically modified plants and their goals Application of molecular biology to plant disease control.	

Specify Course Outcome:

1. The Students will be realized about Physiological and molecular changes brought about in host plants.
2. Students will think how to prevent the production of Enzymes and toxins in plant pathogenesis.

3.They will understand how resistance varieties are developed against different pathogens.

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Lahane S.S Department: Botany

Program: M.sc Sy Subject: Botany Course Code: XVIII-A

Paper Title: Physiological and molecular plant pathology

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Physiological and molecular changes in diseased plants. Physiological changes: Composition of plant cell wall,changes in host cell wall,effects of Pathogens on permeability of cell membrane, effect of infection on photosynthesis, respiration, transslocation of water and nutrients, phenol metabolism and growth regulators(auxin,gibberellin, cytokinins and ethylene) in diseased plants. Changes in the molecular level: Nucleic acid metabolism, protein metabolism, effects of Pathogens on transcription and translation.	The Students will be realized about Physiological and molecular changes brought about in host plants.
II	UNIT II	Enzymes and toxins in plant pathogenesis. Enzymes in pathogenesis:- Cellulolytic Enzymes- types,mode of action, and	Students will think how to prevent the production of Enzymes and toxins

		Pre penetration of pathogen on the host surface, path of infection:Direct penetration, Entry through intact surface(Epidermis),Entry through non cutinized surface(flower,bud and root hairs).Indirect Entry of Pathogens into the host through natural openings(stomata,lenticels and hydathodes) and wounds. Effect of environment on pathogenesis:Effect of temperature, humidity, wind,light,soil reaction (pH),plant nutrition. The Biotic environment: The rhizosphere,phylliplane,Antagonistic association, phenomenon of fungistatis,symbiotic association, synergistic association.	awareness among the farmers for losses caused due to epidemics.
III	UNIT III	Aerobiology,Epidemiology and Disease Forecasting Aerobiology:Airborne Pathogens, Methods for detection of Aerospora,scope and applications of Aerobiology. Epidemiology:Concepts of Epidemiology, slow and rapid epidemics, favorable factors for development of epidemics, conditions for decline of epidemics, Disease Forecasting:General account of plant disease Forecast systems with some examples. Dispersal of plant pathogens:Autonomous dispersal:soil as a mean of Autonomous dispersal,seed as a source of Autonomous dispersal, plant and plant organs as a means of Autonomous dispersal. Passive dispersal:dispersal by air,water,insects, nematodes, animals, man and phanerogames abd plant parasites.	They will opt plant pathology as a profession.
IV	UNIT IV	TDefense mechanism in plants General account, Structural defense: pre existing structural defense:waxes and cuticle, Structure of epidermal cell	

		wall,stomata, mechanical tissues.Post infectional structural defense in host plants:formation of cork layer,tyloses,abscission layers,gum deposition,sheathing of hyphae.Biochemical defense:pre existing biochemical defense:antifungal and antimicrobial compounds released by the plants in its environment, inhibitors already present in the plant cells,Deficiency of essential nutrients for growth of Pathogens. Absence of common antigens.Post infectional biochemical defense:defense through detoxification of pathogen toxins,defense through induced synthesis of proteins and enzymes, defense through hypersensitivity, toxic chemicals produced in plant in response to infection: phenolic compounds and theor role in defense, Phytoalexin:synthesis and characteristics and role,elicitors of Phytoalexin.	

Specify Course Outcome:

1. The Students will be able to understand the importance of plant pathology and will helps to develop interest in plant pathology.
2. They will bring the awareness among the farmers for losses caused due to epidemics.

3.They will opt plant pathology as a profession.

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)I

Name of Teacher: Shelar P.D Department: Botany

Program: MSc S.Y Subject: Botany Course Code: xivA

Paper Title: Diseases of crop plants and their management

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	Scope and Importance of Plant Pathology, Worldwide development of Plant Pathology as Profession and Careers in Plant pathology. History of Plant Pathology with special reference to Indian works., stages in disease development, causes of plant diseases, effect of pathogen on the plants, effect of plant diseases on human affairs Classification of plant diseases: Classification of plant diseases: Criteria used in classification, Classification based on origin (soil, air, and seed), symptoms, causal Organism and spread and severity of infection. Detection and diagnosis of plant diseases.	1.Student will known importance of sign and symptoms for detection of pathogens and disease, integrated method of disease management,use of biological and chemical in disease management. 2.Students will known symptoms, etiology, disease cycle and management of major disease of cereals, pulses,oil and vegetables.

2			**Methods of Studying Plant Diseases in field and in laboratory, Koch'spostulates,**	
3	II	UNIT II	Pre penetration activity of pathogen on the host surface:Direct penetration, Entry through intact surface (Epidermis), Entry through non cutinized surface (flower, bud and root hair). Indirect entry of pathogens into the host: through natural openings (Stomata, Lenticels and Hydathodes) and wounds. Effect of Environment on Pathogenesis: Effect of temperature, humidity, wind, light, soil reaction (pH). The biotic environment: The rhizosphere, Phylloplane, Antagonistic association, phenomenon of fungistatis, symbioticassociation.Dispersal of plant pathogens: Autonomous dispersal soil as a means of autonomous dispersal, seed as a source of autonomous dispersal, plant and plant organs as a means of autonomous dispersal. Passive dispersal: Dispersal by air, water, insects, nematodes,animals, man and phanerogamic plant parasites.	**1.Student will known importance of sign and symptoms for detection of pathogens and disease, integrated method of disease management,use of biological and chemical in disease management.** **2.Students will known symptoms, etiology, disease cycle and management of major disease of cereals, pulses,oil and vegetables.**
4	III	UNIT III	**Structural Defence: Pre existing Structural Defense: Waxes and cuticle, structure of epidermal cell wall, stomata, mechanical tissues.**	**1.Student will known importance of sign and symptoms for detection of pathogens and disease, integrated**

II	UNIT II	Scientific paper writing _manuscript preparation & presentation,research journals,impact factor & paper citation index. Major research Institute related to plant science in India. A breif idea about government research & funding agencies as DST, DBT, ICAR, ICMR, CSIR, UGC, CST, etc. IPR & patenting..	**Develop a appropriate framework for research studies.**
III	UNIT III	**Data collection & analysis: sources of data, primary, secondary & tertiary, types of data categorical, nominal & ordinal. Methods of collecting data observation, field investigation, direct studies reports, records or experimental observation. Methods of collecting data :sampling , data processing & analysis strategies, graphical representation, descriptive analysis. Methods of collecting data: inferential analysis correlation analysis least square, hypothesis testing, generalization & interpretation & modeling.**	
IV	UNIT IV	Scientific writing: structure & components of scientific reports_ types of report technical reports & thesis significance _ different steps in preparation_ layout structure & language of typical reports illustration & tables_ bibliography, referencing & foot notes_ importance of effective communication. Preparing research papers for journals, seminars & conferences_ design of	

		fungicides.Antibiotics, Nematicides, Antiviral chemicals and biopesticides. Biological control.	

Specify Course Outcome:

1.Student will known importance of sign and symptoms for detection of pathogens and disease, integrated method of disease management,use of biological and chemical in disease management.

2.Students will known symptoms, etiology, disease cycle and management of major disease of cereals, pulses,oil and vegetables.

Signature of Teacher

II	UNIT II	History,symptology, causal organisms, etiology and management of following diseases: Citrus -canker ,gummosis , decline,greening,Citrus tristeza disease,scab . Grapes-powdery mildew, Downy mildew,anthracnose of bird's eyes disease, bacterial leaf sopt, alternaria blight.	1.Students will known common pathogens, symptoms, etiology, disease cycle and management of major disease of fruits . 2.plants Students will known common pathogens, symptoms, etiology, disease cycle and management of post harvest disease of fruits plants .
III	UNIT III	History,symptology, causal organisms, etiology and management of following diseases: Papaya - mosaic ,foot rot ,leaf curl ,ring spot. Pomegranate -Alternaria fruit sopt, anthracnose, bacterial blight,cercoscopra fruit spot,wilt.Guava- wilt,die back and anthracnose,fruit canker .	1.Students will known common pathogens, symptoms, etiology, disease cycle and management of major disease of fruits . 2.plants Students will known common pathogens, symptoms, etiology,

			disease cycle and management of post harvest disease of fruits plants .
IV	UNIT IV	Mango- Anthracnose,black mould.Banana- Anthaconse,black end . Citrus - blue mould , mould Grape -gray mould ,blue mould. Pomegranate -soft rot , Aspergillus rot. Papaya - Fusarium rot , Aspergillus rot,Rizopus rot Guava- Rizopus hi, Alternaria rot . Concept of post harvest disease, causes of post harvest disease,principles of plant disease management as post harvest,merits and demerits of biological/phytoextracts in comtroling post harvest disease,factor growing post harvest problems both as biotics and abiotics ,role of physical environment,agro ecosystem leading to quiescent infection.	1.Students will known common pathogens, symptoms, etiology, disease cycle and management of major disease of fruits . 2.plants Students will known common pathogens, symptoms, etiology, disease cycle and management of post harvest disease of fruits plants .

Specify Course Outcome:

1.Students will known common pathogens, symptoms, etiology, disease cycle and management of major disease of fruits .

2.plants Students will known common pathogens, symptoms, etiology, disease cycle and management of post harvest disease of fruits plants ..

Dnyanopasak Shikshan Mandal's

College of Arts, Commerce and Science, Parbhani

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Shelar P.D Department: Botany

Program: MSc S.Y Subject: Botany Course Code: xixA

Paper Title: Diseases of fruits plants and their management

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	UNIT I	History,symptology, causal organisms, etiology and management of following diseases:Mango -Die back/Fruits stem end rot, powdery mildew,grey leaf blight, mango leaf black spot/canker. Banana - Fusarium,wilt/Panama wilt ,sigatoka leaf sopt, bacterial wilt, bacterial moko disease, banana bunchy top disease.	1.Students will known common pathogens, symptoms, etiology, disease cycle and management of major disease of fruits . 2.plants Students will known common pathogens, symptoms, etiology, disease cycle and management of post harvest disease of fruits plants .