

Narayanrao Kale Smruti Model College (Art, Commerce and Science)

Karanja (gh.) Dist- Wardha

COURSE OUTCOME FOR UG DEGREE PROGRAMME

(Based on RTMNU BOS BOTANY syllabus) Session-2022-23

- The course is design for students to understand different branches of Botany such as microbes, lower plants, higher plants, plant pathology, systematic Botany, Paleobotany, Genetics, Ancient Botany, Morphology, Anatomy, Plant Physiology, Plant Biotechnology, Embryology, Cell Biology, Plant Breeding, Evolution, Horticulture, Molecular Biology, Plant Ecology, Biochemistry etc.
 - Various skill development programmes also added for knowledge and future opportunities
 - After completing the course students are able to focus or identify different life forms of plants, design, execute experiments in different branches of botany.
 - They have a capacity to develop knowledge of Basic Botany which is use in research field, tools and techniques in plant sciences and other future aspects also.
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B.Sc I Semester Paper-I

(Viruses, Prokaryotes, Algae and Biofertilizers)

Course objectives- Unit-I

- ✚ Course aim is understanding the various forms of microbes, different forms of viruses, mycoplasma, bacteria etc.

Course Learning outcomes

- ✚ In the learning methods students better understands study of viruses, prokaryotic microorganisms, importance , life cycle, reproduction, characters etc.

Course objectives-Unit-II

- ✚ Objective shows study of *Cynobacteria*, lower plants like Algae as plant ancient life.

Course Learning outcomes

- ✚ Students will developed capacity to understanding *Cynobacteria*, lower plants structure, reproduction, classification, economic importance.
- ✚ Characters help to identify them systematically.

Course Objectives-Unit-III

- ✚ Students have understanding the different lower plants like Algae, diversity, classification etc.

Course Learning outcomes

- ✦ Student get the information about the various forms of Algae like *Chara*, *Vaucheria*, *Ectocarpus* and *Batrachospermum*.
- ✦ Life cycle gives the whole information of particular forms(genus)with structure, classification, reproduction, morphology , anatomy in systematic way.

Course Objectives-Unit-IV

- ✦ University design skill based programme on Biofertilizer, Microbs, Commercial production etc.to develop skillful activity in the students.

Course Learning outcomes

- ✦ Students are totally involved in skill development programme which is benifacial for their future.
- ✦ Students understanding the various aspects related to Biofertilizers.
- ✦ Scope ,importance various forms of Biofertilizers such as *Rhozobium*, *Azatobacter*, PSB and *Azolla* shows diversity, variations in their characters well studied.

Paper-II

(Fungi,Plant Pathology,Lichens,Bryophyta and Mushroom Cultivation)

Course Objectives Unit-I

- ✦ Study of lower plants like Fungi- characters, classification, economic importance ,life history of *Albugo*,*Mucor*,*Puccinia* and *Cercospora* provide basic information to students in their studies.

Course Learning outcomes

- ✦ To increase the knowledge of lower plants specially fungal material.
- ✦ Students compare different fungal material with respects to their classification, economic importance, reproduction and whole life history of *Albugo*,*Mucor*,*Puccinia*,*Cercospora* etc.

Course Objectives Unit-II

- ✦ Plant pathology is a branch of Botany which deals with the study of various plant diseases and introduction of Lichens is an association of two different forms which is included in syllabus for student understanding.

Course Learning Outcomes

- ✦ Students captured the knowledge of plant pathology for better understanding the various diseases found on plants.
- ✦ Plant diseases, symptoms, causes and control of disease on leaf curl of papaya, Citrus canker and red rot of sugarcane included.

- ✦ *Crustose, Foliose* and *Fructicose* Lichen ,their reproduction, economic importance increase the knowledge about Lichens basic studies.

Course Objectives Unit-III

- ✦ In the evolutionary point of view Bryophytic thallus study is most important.
- ✦ From lower to higher plants it is important, lower plant stage shows various forms of plants characters for students understanding purpose.

Course Learning outcomes

- ✦ For the better understanding, students get variations in their characters, classification, economic importance also.
- ✦ Student will develop and understanding various forms of Bryophytic material like *Marchantia*, *Anthoceros* and *Funaria*.
- ✦ Various life forms of Bryophytic material clears the comparative study, classification, reproduction and other characters.

Course Objectives Unit-IV

- ✦ The University design skill development unit on Mushroom Cultivation for study of different Mushroom varieties, tools and technology for learning different aspects which is beneficial for students in their future.

Course Learning outcomes –

- ✦ To develop the skill, knowledge of Mushroom cultivation this unit is design
- ✦ Students get the small scale business ideas by capturing this knowledge.
- ✦ Student understand the basic concepts of Various forms of Mushroom, tools, techniques, cultivation which is very informative.

B.Sc.Semester-II

Paper-I

(Palaeobotany, Pteridophytes, Gymnosperms and Soil analysis)

Course Objectives Unit-I

- ✦ To understand the branch of Botany-Paleobotany shows fossil study, types, geological time scale for study purpose.

Course Learning outcomes

- ✦ Students better understanding the paleobotany-types, geological time scale, fossil leaf, fructification through their characters, importance also.
- ✦ Unit explain the various forms which help in their studies.

Course Objectives Unit-II

- ✦ The unit focus on morphology, anatomy, reproduction, evolution, classification of different forms of Pteridophytes and their different aspects like heterosporous, seed habit, types of steles etc.

Course Learning outcomes

- + Pteridophytic study is evolutionary and modified characters study.
- + It focus on life history of different forms of Pteridophytic materials, classification, reproduction, heterospory, seed habit, types of steles etc.

Course Objectives Unit-III

- + The unit focus on higher plants morphology, anatomy, reproduction, evolution, classification of different forms of Gymnosperm and their different aspects like Fossile Gymnosperms , life cycle etc.

Course Learning outcomes

- + Student understand the Higher plants like Gymnosperm with different aspects.
- + Different life forms like *Cycas*, *Pinus* is important for identification of materials.
- + Plant Morphology, Anatomy, Reproduction , fossile study is also important.

Course Objectives Unit-IV

- + Study of soil is important for students to clear various aspects related to their texture, types, method physical and chemical properties etc.

Course Learning outcomes

- + Skill development unit develop skillful programmes for students for their better future.
- + Soil study helps the students to understanding texture of soil, types, methods, soil samples physical and chemical properties for various aspects in future.

Paper-II

(Morphology of Angiosperms and Floriculture)

Course Objectives Unit-I

- + The course aim is to understand the Morphology of root, stem, leaves of higher plants like Angiosperms.

Course Learning outcomes

- + The Morphology of Angiosperm the knowledge of root, stem and leaf its types, modification, phyllotaxy, venation is important for better understanding of students.

Course Objectives Unit-II

- + In the morphology of Angiosperms, reproductive morphology, flower study, calyx, corolla, androecium is important factors in study point of view for students.

Course Learning outcomes

- ✚ Inflorescence, flower study, calyx, corolla, androecium helps to understanding the various aspects of morphology of angiosperms.
- ✚ Reproductive morphology clears different aspects related to flower, inflorescence etc.

Course Objectives Unit-III

- ✚ Reproductive morphology shows study of gynoecium, different types of fruits etc. helps to understanding the students.

Course Learning outcomes

- ✚ Study of carpel and fruit gynoecium shows various parts and their studies.
- ✚ Fruit study helps the students for types of fruits.

Course Objectives Unit-IV

- ✚ Skill development studies based on Floriculture study for better understanding the commercial aspects, important flowers, environmental conditions, fertilizers, harvesting, diseases and control measures etc.

Course Learning outcomes

- ✚ Students gives inspiration by designing such types of courses.
- ✚ Floriculture, commercial aspects, methods of cultivation, environmental condition, fertilizers, harvesting, diseases and control measures shows overall knowledge of floriculture which is beneficial for future study.

B.Sc.Semester -III

Paper-I

(Angiosperm Systematics, Embryology and Indoor Gardening)

Course Objectives Unit-I

- ✚ Students learn about systematic botany of angiosperm, fossile angiosperms, angiosperms taxonomy, nomenclature, modern trends in taxonomy, phytochemistry etc.

Course Learning outcomes

- ✚ Student will known the knowledge about systematic botany, fossile angiosperms, angiosperm taxonomy botanical nomenclature, modern trends in taxonomy.
- ✚ Angiosperm systematic shows different theories and aspects.

Course Objectives Unit-II

- ✚ Systems of classification, different families were involve for students understanding purpose.

Course Learning outcomes

- ✚ Students understand Bentham and Hooker, Engler and Prantle systems comparatively
- ✚ Dicot and monocot families is very important for study of family characters.

Course Objectives Unit-III

- ✚ To learn the reproductive study like embryology, anther, ovule, fertilization is important for better understanding the students .

Course Learning outcomes

- ✚ Embryological studies shows micro and megasporogenesis, gametophyte development, fertilization, dicot and monocot embryo stages for students understanding.

Course Objectives Unit-IV

- ✚ Skill development unit totally based on indoor gardening, landscaping, house plants for future benefits of the students .

Course Learning outcomes

- ✚ Landscaping, indoor gardening, popular house plants, foliage plants describe various ideas about indoor gardening.
- ✚ Different forms of plants, indoor ideas, different landscaping helps to learn more factors about it for students.

Paper-II

(Angiosperm Anatomy and Horticulture)

Course Objectives Unit-I

- ✚ Angiosperm Anatomy shows study of higher plants on anatomical level tissue system, meristematic tissue, cambium study is important for students understanding.

Course Learning outcomes

- ✚ Study shows anatomy, simple permanent tissue, complex permanent tissue and their functions, apical meristem of root and shoot , cambium etc. for learning and better understanding of the students.
- ✚ Different theories helps to understand the apical meristem of root and shoot.

Course Objectives Unit-II

- ✚ Primary and secondary growth in stem and root, normal primary structure of root, normal primary structure of stem, normal secondary growth in dicot stem, anomalous secondary growth helps to better understanding the tissue systems and anatomical features.

Course Learning outcomes

- ✚ Types of vascular bundle, dicot and monocot root, dicot monocot stem, Sunflower *Bignonia*, *Dracaena* stem transverse section shows anatomical structure understand by students.
- ✚ T.S.of root, T.S.of stem of dicot and monocot stem and root ,vascular bundle well understand by students.

Course Objectives Unit-III

- ✚ Focus on different aspects of wood, periderm, anatomy of leaf , Senescence and abscission.

Course Learning outcomes–

- ✚ Study of different aspects of periderm, growth rings. sap wood, heart wood, periderm, anatomy of leaf scnescence and abscission included for learning and better understanding purpose of students.

Course Objectives Unit-IV

- ✚ Skill development unit based on Horticulture scope, importance, management, methods of propagation techniques etc.

Course Learning outcomes –

- ✚ Horticulture is a branch of Botany which focus on the study of various methods, Bonsai techniques etc. for understanding purpose.
- ✚ Rose, *Chrysanthemum*, Crotons, Mango, Citrus, Guava. Liliium are horticultural crops for students study.

B.Sc IV Semester

Paper-I

(Cell Biology, Plant Breeding, Evolution and Seed Technology)

Course Objectives Unit-I

- ✚ Cell organization, structure and functions of various cell organelles were well included for understanding of the students.

Course Learning outcomes

- ✚ Study of cell, prokaryotic and eukaryotic cell organization, various cell organells ultrastructure, functions is present in the unit for students understanding purpose.

Course Objectives Unit-II

- ✚ Structure and function of different cell organells, chromosome morphology, molecular organization of chromosome, sex chromosomes, cell division included for cell and chromosome study.

Course Learning outcomes

- ✚ Structure and functions of cell organelles, chromosome morphology, nucleosome model, sex chromosome, mitosis and meiosis for study purpose.
- ✚ Cell biology is a branch of Botany for the study of cell, chromosome, cell division and other study etc.

Course Objectives Unit-III

- ✚ Two different branches are included in this unit like Plant breeding, Biostatistics.

Course Learning outcomes

- ✚ Plant breeding is a term related to Agriculture, its methods of breeding focus of different aspects for better understanding.
- ✚ Biostatistics includes mean, mode, median, standard deviation, standard error etc for living organisms statistical analysis.
- ✚ Some evolutionary theories also included for study purpose.

Course Objectives Unit-IV

- ✚ Skill development unit based on seed technology, seed dormancy commercial types etc. for technological understanding of seed data.

Course Learning outcomes

- ✚ Skillful knowledge of various techniques of seed, dormancy of seed storage, genetic erosion, production, testing, certification, commercial type important for seed identification purpose for students.

Paper-II

(Genetics, Molecular Biology and Plant Nursery)

Course Objectives Unit-I

- ✚ Study of genetics, interaction of genes, linkage, crossing over different aspects included in this unit for understanding purpose.

Course Learning outcomes

- ✚ Mendelism, law of segregation, law of independence assortment, gene interaction, crossing over included in genetics study.
- ✚ Study of gene its various factors are important for students.

Course Objectives Unit-II

- ✚ In this unit included Study of genetics, chromosomal aberrations, variation in chromosome number, DNA damage and repair for learning and understanding of students.

Course Learning outcomes

- ✚ Students understand the study of mutation, mutagenic agents, chromosomal aberrations, polyploidy, photoreactivation and excision repair etc.

Course Objectives Unit-III

- ✚ Study of molecular biology, RNA, Concept of gene, genetic code, protein synthesis, regulation of gene action are various aspects presents in this unit for students understanding.

Course Learning outcomes

- ✚ Structure of DNA, Watson and Crick Model, DNA replication, t-RNA model Concept of gene, genetic code, Protein synthesis, Lac-operon model were well understand in this study.

Course Objectives Unit-IV

- ✚ Skill development unit design on Nursery techniques, management for small scale business ideas in future for students.

Course Learning outcomes –

- ✚ Nursery infrastructure, planning and seasonal activities, nursery management techniques provides information of skill based ideas for students.
- ✚ Layering, budding, grafting, cutting are very important technique in nursery management for learning purpose.

B.Sc.Vth Semester

Paper-I

(Plant Physiology, Mineral Nutrition and Hydroponics)

Course Objectives Unit-I

- ✚ Different physiological aspects were studied like Plant water relation, ascent of sap, transpiration, phloem transport, mineral uptake for learning purpose of students.

Course Learning outcomes

- ✚ Imbibition, diffusion, osmosis, O.P, DPD, Plasmolysis, ascent of sap theories, stomatal movements, Munch hypothesis, active and passive concept included in this study
- ✚ Plant physiological aspects understand by students in this unit.

Course Objectives Unit-II

- ✚ The students understand the process of Photosynthesis, Respiration, mechanism, fermentation etc. for understanding of both the process.

Course Learning outcomes

- ✚ The study focus on Photosynthesis, Respiration, mechanism, fermentation etc.
- ✚ Different aspects like pigment systems, photophosphorylation, dark reaction, light reaction,RQ, Glycolysis Kreb's cycle, ETS ,Fermentation were included for better understanding of students.

Course Objectives Unit-III

- ✚ Nitrogen fixation, plant movements, photoperiodism, Circadian rhythms and Biological clock are included in this unit for students understandings.

Course Learning outcomes

- ✚ Symbiotic and non-symbiotic N-Fixation, various movements of plants, SDP, LDP, DNP included in this for learning purpose.

Course Objectives Unit-IV

- ✚ Skill development unit based on mineral nutrition and hydroponics for better plant study .

Course Learning outcomes

- ✚ Skill based syllabus helpful for future benefits for students
- ✚ Mineral nutrition, macro-micronutrients, role of deficiency symptoms are important for mineral study.
- ✚ Hydroponics plants gives various techniques, nursery composition, methods for Tomato, Cucumber, Spinach and Cabbage etc for students understanding.

Paper-II

(Plant Ecology and Organic Farming)

Course Objectives Unit-I

- ✚ The unit includes plant environment, climatic factors, edaphic factors, physiographic factors for the study of plant ecology and different aspects for students understanding.

Course Learning outcomes

- ✚ Ecology and branches, gaseous composition, pedogenesis, physiographic factors, biotic factors are included for students understanding purpose.
- ✚ Plant ecology information essential for study different aspects of ecological factors.

Course Objectives Unit-II

- ✚ Plant ecology shows ecological aspects like ecosystem, autecology, synecology for understanding of students.

Course Learning outcomes

- ✚ Biotic and abiotic components, food chains, food web, ecological pyramids, ecotypes, ecads, community, density, abundance qualitative characters for ecosystem study focus on ecological study.

Course Objectives Unit-III

- ✚ The plant succession, adaptation, biogeochemical cycle helps to understand different aspects of plant ecology .

Course Learning outcomes

- ✚ Succession, hydrosere, xerosere, hydrophytes study, xerophytes study, halophytes, epiphytes, study include in plant ecology in this unit.
- ✚ Nitrogen and phosphorous cycle also important for biogeochemical cycle for better understanding the students.

Course Objectives Unit-IV

- ✚ Skill development unit based on organic farming, methods, organic manure etc. for students understanding purpose.

Course Learning outcomes –

- ✚ Study of organic farming, advantages disadvantages, organic fertilizers, biodegradable waste, biocompost, vermicompost are included in this unit.
- ✚ Students are better understanding organic farming by gaining knowledge with different aspects for future benefits.

B.Sc. VI th semester

Paper-I

(Biochemistry, Biotechnology and Herbal Technology)

Course Objectives Unit-I

- ✚ To study the different aspects of Biochemistry, enzymology, enzyme action, enzyme inhibitor and their various terms are included in this unit.

Course Learning outcomes

- ✚ Biochemistry is a branch of Botany which deals with the study of enzymology, β -Oxidation, Glyoxylic acid cycle ,nomenclature, classification, characteristics of enzymes etc. included for students understanding purpose.
- ✚ Properties of enzymes, concepts of enzymes, Enzyme substrate complex theory, lock and key theory. induced fit model ,compitative and noncompitative inhibitors of enzyme are included to study different aspects of biochemistry.
- ✚ Study of enzyme is increase the knowledge of students for understanding purpose.

Course Objectives Unit-II

- ✚ The course aim includes concepts, instrumentation, scope ,basic requirments and applied aspects of plant tissue culture. Also included culture media, protoplast culture, applications etc. to help the students increasing knowledge of these Biotechnology branch.

Course Learning outcomes

- ✚ Student will developed interest to study new branch of Biotechnology.
- ✚ To study basic properties of PTC. New and advance branch of Biotechnology for learning purpose and future aspects also.
- ✚ Plant tissue culture various aspects, properties, media preparation, culture techniques, application of PTC are important study for students understanding.

Course Objectives Unit-III

- ✚ The course is design to study Genetic engineering as a advanced branch of Biotechnology for students. Cloning vectors, DNA Library, *Agrobacterium* mediated gene transfer included for better study purpose of the students.

Course Learning outcomes

- ✚ Basic principles , application of genetic engineering, tool techniques are included in this unit.
- ✚ Restriction enzymes, Cloning vectors, Plasmid, C-DNA library, Ti- plasmid and role of biotechnology in crop improvement are various aspects included for learning and understanding for students.
- ✚ The study helps in gaining knowledge of advance technology.

Course Objectives Unit-IV

- ✚ The skill development unit based on herbal technology which focus on herbal importance, concepts, methods, dye yielding herbal plants which is most useful for developing knowledge in this field.

Course Learning outcomes

- ✚ Herbal Technology shows different concepts related to drugs, cosmetics, natural dyes various dye yielding plants which helps to creat new ideas and concepts about this course.
- ✚ Students understand this skill development programme for future in developing small scale business ideas for them.

Paper -II

(Phytogeography, utilization of Plants, Techniques and Pharmacognosy)

Course Objectives Unit-I

- ✚ The unit cover phytogeography, pollution, natural resources, environmental pollution, conservation strategies were well studied through this for students understanding.

Course Learning outcomes

- ✚ From the above objectives it is seen that phytogeography, distribution, climatic region, agriculture pollution, noise pollution, renewable and non-renewable resources are most important factors for understanding point of views.

- ✚ The conservation strategies includes conservation of forest and water resources.
- ✚ This conservation information, different resources, pollution aspects also help in their studies.

Course Objectives Unit-II

- ✚ The study includes utilization of plants and ethnobotany, ethnobotanical importance and their different aspects helpful for understanding of students.

Course Learning outcomes –

- ✚ Plants different constituents, food, oil, fiber, spices, beverages, rubber are economically most important for understanding of students.
- ✚ Students acquire knowledge about ethnobotany its different aspects, vegetables, fruits, seeds, medicinal and narcotics plants are most important in learning purpose.

Course Objectives Unit-III

- ✚ The unit define study of microscopy and its techniques which is helpful for students in their understanding purpose.

Course Learning outcomes

- ✚ Study of microscopy, principle, application of microscope (Light, Fluorescent ,SEM and TEM) are important for knowledging of instruments like microscope and their different types.
- ✚ Light, Fluorescent ,SEM and TEM are advanced microscopy for study.
- ✚ Techniques of microscopy includes centrifugation, electrophoresis, spectroscopy, chromatography helps to understand different aspects about this.
- ✚ Paper chromatography and thin layer chromatography helps to detect different types of drugs, chemical constituents which is very helpful for their understanding.

Course Objectives Unit-IV

- ✚ The skill development unit design for different Techniques for pharmacognocny, pharmacological plants, drug extraction methods which is very helpful information for students in understanding the term pharmacognosy.

Course Learning outcomes

- ✚ Drug adulteration, evaluation, phytochemical screening, secondary metabolite are the term related to Pharmacognosy which give informative data through this unit.
- ✚ Drug extracted from plants, constituents, preparation, microchemical tests are important for studying various aspects, ideas of term pharmacognosy for better understanding the unit.
- ✚ Skill base programme helps to develop small scale business ideas for future.