Course Title	Course Code	Credit
Phycology	BOTUGMCC1101	4 (Theory 3, Practical 1)

Course Objectives

The learning objectives of this course are as follows:

- *To know the habits, habitats and range of thallus organization in algae.*
- *Detailed knowledge of the cell structure, reproduction and life cycle of Cyanophyta, Cholorophyta, Charophyta, Phaeophyta, Rhodophyta, and Xanthophyta.*
- *To understand the general characteristics, classification, and cell structure of algae along with the significant contributions of important Phycologists.*
- *To know the origin and evolution of sex*
- *To know the role of algae in the Environment, Agriculture, Biotechnology and Industry.*

Course Outcomes

By studying this course, students will be able to:

- *Students will learn about the range of thallus organization in algae, evolutionary classification by important Phycologists, and method of reproduction.*
- *Students will learn their role in the environment, agriculture, biotechnology and industry.*
- *Students will come to know about ecology, cell structure, reproduction, genetic recombination of Cyanophyta along with the life cycle of Vaucheria*
- *They will learn the details of the life cycles of Volvox, Zygnema, Oedogonium, Coleochaete and Chara.*
- *They will learn detailed information on cell structure, reproduction and life cycles of Fucus and Polysiphonia.*

Theory

Unit 1: General Account

General characteristics; range of thallus organization, Structure of algal cell (Cell wall, Plastid and Flagella), Methods of Reproduction; Classification, Origin and evolution of sex, Significant contributions of important phycologists (F.E. Fritsch & M.O.P. Iyengar), Role of algae in the Environment, Agriculture, Biotechnology and Industry.

Unit 2: Classifications

Criteria, General concept of Endosymbiosis and basis of Fritsch's classification (Fritsch' 1935 (only upto class), Classification by Lee (2008) upto phylum with examples, Salient features of Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta, Charophyta.

Unit 3: Ultrastructure of Cell

Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta, Charophyta.

Unit 4: Cyanophyta

Ecology, Genetic recombination, Heterocyst - structure and function,

Unit 5: Bacillariophyta

Cell division, Auxospore formation in Centrales and Pennales.

Unit 6: Life History

Chlamydomonas, *Vaucheria*, *Oedogonium*, *Chara*, *Ectocarpus*, *Polysiphonia*, Evolutionary significance of *Prochloron*.

Practical

1. Preparation of permanent slides during practical classes.
2. Identification of all the genera included in the theoretical syllabus from Permanent slides (vegetative and reproductive structures).

3. Study and Camera Lucida drawings of vegetative and reproductive structures of Nostoc, *Chara, Vaucheria, Ectocarpus*, *Scytonema*, Zygnema and *Oedogonium* through temporary preparations.
4. Study of vegetative and reproductive structures of *Fucus, Chlamydomonas*, *Coleochaete* and *Polysiphonia* through electron microphotographs.
5. Demonstration of algae culture.
6. Field visit

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013). Prescott's Microbiology. 9th Edition. McGraw-Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.

Course Title	Course Code	Credit
Biomolecules	BOTUGMCC1102	4 (Theory 3, Practical 1)

Course Objectives
This course is designed to give the students • *The understanding of acids, bases and buffers and their relevance in living systems.* • *The information about the structure and function of various biomolecules such as carbohydrate, protein (including their role as biocatalysts) and nucleic acids.* • *The knowledge about enzymes and catalysis.* • *Use of various techniques involved in biochemical analysis.*
Course Outcomes
After completion of the course, a student will be able to achieve these outcomes: • *The students will learn about the chemical structures of carbohydrates, and their structural and metabolic role in cellular systems.* • *The students will learn about structure and function of lipids, circulating lipids and inflammatory lipid mediators etc.* • *They will also learn about primary, secondary, tertiary, quaternary structure of proteins.* • *The students will understand about the structure and function of nucleosides and nucleotides.* • *The students will learn about the enzymes and various enzymatic mechanisms in the biological system.* • *Students will learn the application of various techniques used in biochemical analysis.*

Theory

Unit 1: Water and Buffer
Physical properties of water, structure of water molecule, Ionization of water, Bronsted – Lowry concept of acid and bases, Concept of pH of weak acids and weak bases, Henderson-Hasselbalch equation, concept of buffer, strength of buffer, buffer value, important biological buffers (with the help of numerical problems). Forces involved in biomolecular interactions with examples: Van der Waals interactions, electrostatic interactions, hydrogen bond and hydrophobic interaction.

Unit 2. Stereochemistry
General concepts on: Plane of symmetry, centre and axis of symmetry; Concepts of chirality; optical isomerism; geometrical isomerism; DL, RS nomenclature; Projection formula (Fischer & Howarth); Isomers: anomers, epimers; Stereochemistry of cyclohexane: idea of axial & equatorial bonds (related to chair form conformation). Configuration versus conformation.

Unit 3: Carbohydrates
Structure and Biological importance of Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates.

Unit 4: Lipids
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

Unit 5: Proteins
Amino acids: Structure, Classification and General Properties of α-amino acids; Physiological importance of essential and non-essential α-amino acids. Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins.

Unit 6: Nucleic Acids

Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids; Cot Curves: Base pairing, Denaturation and Renaturation of DNA. Types of DNA and RNA, Complementarity of DNA, Hypo- Hyperchromaticity of DNA

Unit 7: Enzymes
Nomenclature and classification; Cofactors; Specificity of enzyme action;Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action.

Unit 8. Vitamins
Classification and characteristics with suitable examples, sources and importance

Practical

1. Concept of molarity, normality, percentage, dilutions, pH and buffers.
2. Preparation of buffers and Numerical problems to explain the concepts.
3. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
4. Paper chromatography of amino acids.
5. Protein Estimation

Suggested Readings

1. *Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, VEdition, W.H. Freeman and Co., New York.*
2. *Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition,W.H. Freeman and Co., New York.*
3. *Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition,International Edition, The McGraw- Hill Companies Inc.*
4. *Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, IIEdition, BIOS Scientific Publishers Ltd., U.K.*
5. *Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab.Press, Pearson Pub.*
6. *Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons*

Course Title	Course Code	Credit
Biology for Sustainable Development	BOTUGSEC1101	3

Course Objectives
The learning objectives of this course are as follows: • This course intends to develop awareness about the importance of sustainable development in the modern world • Implementation and achievement of sustainable development goals • To understand the significance of sustainable development in ecological context • To harness various biological concepts in achieving sustainable development goals
Course Outcomes
By studying this course, students will be able to: • Learn the concept of sustainable development in modern world • Understand the implications of biology in achieving sustainable development goals • Traditional and modern techniques in organic farming, soil and water conservation • Recent developments on biodegradable and bio-based alternatives for commercial use • Understanding the concepts of bioenergy and its potential • Implications of biowaste and recycle management for sustainable development

Unit 1: Sustainable development: Concept of sustainable development; Brief introduction to sustainable development goals; Role of Biology in sustainable development.

Unit 2: Organic farming: Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and industrial wastes – bio compost making methods, types and method of vermicomposting – field application, Biofertilizers (nitrogen fixation and phosphate solubilization), Sustainable techniques in aquaculture.

Unit 3: Bioenergy: Biotech feed, Silage, Bio manure, biogas, biofuels – advantages and processing parameters, Next-generation biofuels, concept of waste-to-energy conversion, various aspects of bioenergy technology.

Unit 4: Soil and water conservation: Advanced green technologies, biologicals and bioreactor-based waste water treatment strategies. Application of algae in soil conservation. Role of plants in rehabilitation of agricultural lands. Bioremediation and phytoremediation techniques for sustainable development.

Unit 5: Biodegradable and bio-based alternatives: Biodegradable polymers and bioplastics, eco-friendly and sustainable packaging techniques, concept of bio-based alternatives and revival of pre-plastic era.

Unit 6: Biowaste and recycling management: Concept and types of biowaste, environmental effects of biowaste and biomedical waste. Impact of biowaste management in bioeconomy, concept of zero-waste management and its implication in sustainable biowaste recycling.

Suggested readings

1. Mamta Bansal, Basics of Organic Farming, CBS Publishers and distributers, ISBN: 9789386478351.
2. Baskar Gurunathan (Editor), Renganathan Sahadevan (Editor), Zainul Akmar Zakaria (Editor), Biofuels and Bioenergy: Opportunities and Challenges, Elsevier 1st ed. 0323852696
3. Amrat Sinore, Endalikachew Kissi, Abebayehu Aticho, The effects of biological soil conservation practices and community perception toward these practices in the Lemo District of Southern Ethiopia, International Soil and Water Conservation Research, Volume 6, Issue 2,

2018, Pages 123-130, ISSN 2095-6339, https://doi.org/10.1016/j.iswcr.2018.01.004.

Course Title	Course Code	Credit
Mycology and Phytopathology	BOTUGMCC1203	4 (Theory 3, Practical 1)

Course Objectives
The learning objectives of this course are as follows: • *To educate students about the various controlling and coordinating systems of animal and human physiology.* • *The course will provide a thorough understanding of the normal body function and helps to determine the cause of disease.* • *It will enable the development of new and more effective treatments and guidelines for maintaining good health.* • *It will equip the students with the ability to pursue careers in medical and healthcare sectors, pharmaceuticals and other related areas.* • *It will help in understanding how these systems interact among themselves to maintain stability or homeostasis.*
Course Outcomes
By studying this course, students will be able to: • *Appreciate human physiology and have enhanced knowledge.* • *Recognize and identify principal tissue structures and functions* • *Understand the functions of important physiological systems including the nervous system, muscular system, endocrine and reproductive system* • *Learn an integrative approach to understand how these separate systems interact to yield integrated physiological responses to maintain homeostasis in the body along with feedback mechanisms.* • *Synthesize ideas to make the connection between knowledge of physiology and real-world situations, including healthy lifestyle decisions and problems faced due to homeostatic imbalances* • *Perform, analyze and report on experiments and observations in physiology.* • *Know the fundamentals and understand advanced concepts so as to develop a strong foundation that will help them to acquire skills and knowledge to pursue an advanced degree.*

Theory

Unit 1: Introduction to true fungi
General characteristics; Affinities with plants and animals; Unique properties of fungi; Thallus organization; Cell wall composition; Nutrition; Classification (Alexopoulos and Mims, 1979, and Ainsworth 1973). Basic outline of classification of Hawksworth 1995 and 2001.

Unit 2: Chytridiomycota and Zygomycota
Characteristic features; Thallus organisation; Life cycle with reference to *Synchytrium* and *Rhizopus*.

Unit 3: Ascomycota
General characteristics, sexual reproduction and development of ascus and ascospores, types of ascocarp; Phenomenon of heterokaryosis and parasexuality in asexual members; Life cycle of *Saccharomyces, Talaromyces*, *Neurospora* and *Ascobolus*.

Unit 4: Basidiomycota
General characteristics; Phenomenon of dikaryotization, development of basidia and basidiospores and basidiocarp, Life cycle of *Puccinia* (Physiological Specialization) and Agaricus, Bioluminescence, Fairy Rings.

Unit 5: Allied Fungi
General characteristics; Status of Slime moulds, Occurrence; Types of plasmodia.

Unit 6: Oomycota
General characteristics; Life cycle of *Phytophthora* and *Albugo*.

Unit 7: Symbiotic associations
Lichen - Occurrence; General characteristics; Range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza with special reference to VAM and their significance.

Unit 8: Applied Mycology
Role of fungi in biotechnology; Application of fungi in food industry (Flavour and texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides.

Unit 9: Phytopathology
Terms and concepts; General symptoms; Geographical distribution of diseases; Symptomology; Koch's Postulate; Host-Pathogen relationships; Concepts and PAMP and PRR. Role of enzymes and toxins as pathogenic weapons. Disease cycle and environmental relation; Host defence mechanism (pre and post infection); prevention and control of plant diseases (biological & chemical); Prevention through quarantine and cultural practices. Bacterial diseases-Citrus canker and bacterial blight of rice. Viral diseases-Tobacco Mosaic virus. Fungal diseases and Control - Late blight of potato. Ergot of rye; Black stem rust of wheat, loose and cover smut of wheat, White rust of crucifer

Practical

Mycology
1. Study of the following genera and their identification: *Rhizopus, Talaromyces, Alterneria, Ascobolus, Agaricus and Polyporus*.
2. Identification of all the macroscopic and microscopic genera included in the theoretical syllabus.
3. Culturing of fungi. Concept of pure culture and identification.

Plant Pathology
1. Identification of diseases prescribed in the theoretical syllabus.
2. Study of the following diseases: White rust, Rust of wheat/Justicia, loose smut of wheat.
3. Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early & Late blight of potato, Black stem rust of wheat and White rust of crucifers.
4. Mycorrhizae-Ecto and Endo mycorrhizae (photographs only)

Suggested Readings

1. Agrios, G.N. (1997). Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan

Course Title	Course Code	Credit
Plant Morphology	BOTUGMCC1204	4 (Theory 3, Practical 1)

Course Objectives

The learning objectives of this course are as follows:

- To know the vegetative as well as reproductive features of the plants.
- To know the plant growth habits and the overall architecture of the plant.
- To identify the plants based on the most important morphological features
- To estimate the average size of the leaf and leaf frequency.
- To measure the average length of internodes as well as petiole.
- To know the arrangement of phyllotaxy
- To know the arrangement of flowers on the inflorescence
- To know the mechanism of pollination
- To know the seed dispersal mechanism
- To know the type of placentation

Course Outcomes

By studying this course, students will be able to:

- Defines "plant morphology".
- Explain the morphological features of plants.
- Expresses the working area of plant morphology.
- Explain the external morphological structure and functions of root and stem
- Distinguishes root tips constituent parts and Identifies Root metamorphosis
- Distinguishes stem parts and Identifies stem metamorphosis
- Explain the external morphological structure and function of leaves and flowers
- Identifies parts of leaves, flowers and their arrangements
- Explains leaf metamorphosis and leaf arrangement
- Explains inflorescences and sex distribution in the flower"
- Explain the mechanism of pollination
- Explain the seed dispersal mechanism
- Explain the type of placentation
- Students can identify unknown plants based on different morphological characters

Theory

Unit 1: Morphology of Root and Shoot (Bud and Stem)
Characteristics of Roots, Regions of a typical root, Modification of Roots; Kinds of Bud, Modification of Buds; Characteristic features of Stem, Surface of Stem, Kinds of Stem, Modified Stem.

Unit 2: Morphology of Leaves
Types of Leaves, Kinds of Leaf, Parts of a Leaf, Ligule and Auricle, Stipules, Leaf Lamina (Shape, Surface, Base, Margin, Apex, Texture); Venation: Types, Types of Leaves, Phyllotaxy, Modification of Leaves.

Unit 3: Morphology of Inflorescences
Types of Bracts, Types of Inflorescence and Examples.

Unit 4: Morphology of Flowers
Definition, Parts of a typical flower, Different types of Flower, Flower is a modified shoot; Floral parts: Thalamus, Insertion of floral leaves on the thalamus; Calyx: Types, Modification; Corolla:

Types, Forms; Perianth; Aestivation; Androecium: Types, Filament, Connective, Anther, Attachment of Anther with the filament, Dehiscence of Anthers, Union of Stamens; Gynoecium: Parts, Ovary-types, Style-types, Stigma-types; Placentation: Types, Structure of Ovule, Types of Ovule, Floral formula, Floral diagram.

Unit 5: Pollination
Types, Contrivances for Self-pollination, Contrivances for Cross-pollination, Agents for Cross-pollination, and Mechanism of Pollination in some common plants.

Unit 6: Fruits and Seeds
Types, Parts of a Fruit, Classification of Fruits; Definition, General structure of Seed, Types of Seed, Types of Seed germination, Economic importance of Seeds, Dispersal of Fruits and Seeds.

Practical

1. Study of vegetative and floral characters of the following families:
   Alismataceae, Araceae, Asteraceae, Brassicaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Nymphaeaceae, Orchidaceae, Poaceae and Solanaceae.
2. Preparation of a temporary slide for the observation of pollen grains.
3. Study of morphological adaptive features of xerophytes and hydrophytes
4. Preservation of different types of seeds
5. Excursion (Local and outstation, mandatory for each student)

Suggested Readings

1. Bhattacharya et al. (2016). A Textbook of Botany. New Central Book Agency, Pvt. Ltd., Kolkata.
2. Singh, (2019). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi.4th edition.
3. Sharma O.P. (2009). Plant Taxonomy. Tata McGraw-Hill Publishing Company Limited.
4. Mitra et al. (2020). Studies in Botany. Moulik Library, Kolkata, India.
5. Gangulee, H.C., Kar, A.K. (2011). College Botany, Vol. II. New Central Book Agency (P) Ltd., Kolkata, India.

Course Title	Course Code	Credit
Biostatistics	BOTUGMDC1202	3

Course Objectives
The learning objectives of this course are as follows: • *To introduce students to the basic concepts of statistics, probability and probability distributions.* • *To teach them the different probability distributions and their application in statistical analysis* • *To familiarize them with various tests of fit analysis methods.* • *To introduce the concept of database, in-silico tools for biological sciences* • *To expose them about the various stages of drug development.*
Course Outcomes
After completion of the course the students would be • *Well versed with sampling methods for biological sciences and their statistical analysis.* • *Able to analyse of data for test of fit analysis* • *Able to access the various biological databases and retrieve the information* • *Enabled to analyse the data using different in-silico tools.*

Unit 1: Descriptive Statistics

Data in Biology: Development in biostatistics, samples and populations, techniques of sampling (random and stratified), sampling and non-sampling errors, variables in biology, univariate and bivariate frequency distributions

Measures of Central Tendency: means, mode, median.

Measures of Dispersion: Range, standard deviation, coefficient of variance and covariance.

Measures of Skewness: Pearson's coefficients of skewness; Measures of Kurtosis.

Unit 2: Probability and Probability Distributions

Probability: Basic concepts, addition and multiplication rules of probability, conditional probability

Probability Distributions: Probability mass function, probability density function and distribution function. Binomial distribution, Poisson distribution, normal distribution and exponential distribution along with their properties and relationships.

Unit 3: Correlation and Linear Regression

Correlation Analysis: Scatter diagrams, Pearson's and Spearman's coefficients of correlation, coefficient of determination.

Regression Analysis: Method of least squares, equations of lines of regression and their applications in biostatistics.

Unit 4: Hypothesis Testing

Sampling distributions and standard error, null and alternate hypothesis, basic concept and illustrations of type I and type II errors, concept of confidence interval estimation.

Student's t-distribution: test for single mean, difference of means and paired t- test, chi-square distribution.

Unit 5: Statistical software

Study of different statistical software, data analysis using different software.

Suggested Readings

1. A. Edmondson and D. Druce : Advanced Biology Statistics, Oxford University Press; 1996.
2. W. Danial : Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc; 2004.

Course Title	Course Code	Credit
Economic Biology	BOTUGSEC1202	4 (Theory 3, Practical 1)

Course Objectives
The learning objectives of this course are as follows: • *To inculcate self-reliant skills from biology perspectives.* • *To enhance commercial viability of biological knowledge in real-time world.* • *To generate human resources that can establish small-scale industries that can generate job opportunities for the lowest of the lows in society.* • *To develop "Atmanirbhar Bharat" and producing bioentrepreneurs for sustainable development of the society as a whole.*
Course Outcomes
By studying this course, students will be able to: • *Develop knowledge in wide range of traditional and modern applications of biology in commercial perspective.* • *Gain knowledge in apiculture and sericulture, both of which are commercially viable skills that can be established as a small-scale startup programme.* • *Gain knowledge of aquaculture that will help the students to initiate startup in fisheries related to food or ornamental aquariums.* • *Establish home-grown mushroom cultivation that is a rich source of protein and vitamins. Mushroom cultivation is among the trending small-scale startup ideas that require minimum financial capital but have significant monetizing potential.* • *Gain skills in horticulture, establish nurseries of economically important plant saplings including ornamental and medicinal plants. There is also high demand for professional garden maintenance companies in modern residential and commercial complexes.* • *Knowledge of applications of microbes in consumer-based industries can help generate skills of producing unique flavors and aroma in various food items. It also opens up options of producing intellectual properties that may have monetizing potential.*

Unit 1: Apiculture

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth. Bee Pasturage; Selection of Bee Species for Apiculture; Bee Keeping Equipment; Methods of Extraction of Honey (Indigenous and Modern). Bee Diseases and Enemies Control and Preventive measures. Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

Unit 2: Sericulture

Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races. Exotic and indigenous races; Mulberry and non-mulberry Sericulture. Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances; Disinfectants: Formalin, bleaching powder, Silkworm rearing technology: Early age and Late age rearing. Types of mountages; Spinning, harvesting and storage of cocoons.

Unit 3: Aquaculture

Principles, definition and scope; Water-quality criteria for Aquaculture: Role of temperature, pH, salinity, dissolved oxygen, ammonia, nitrite, nitrate, phosphate

Fish Nutrition: Regulation of food intake, environmental factors and feed intake, digestive physiology and nutrient digestibility in fishes, Fish growth estimation, Feed content estimation and food formulation

Difference between major and minor carps with examples; Composite fish farming: General concepts, advantages and disadvantages; Induced breeding: method and advantages; Integrated fish farming.

Unit 4: Mushroom Culture Technology

Types of edible mushrooms available in India – *Volvariella volvacea, Pleurotus sajor-caju, Calocybe indica,*

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

Unit 5: Horticulture

Definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants. **Vegetative propagation:** Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants – green house - mist chamber, shed root, shade house and glass house. Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

Unit 6: Microbes in industry

Microbes in food, dairy, pharma and industry. Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.

Suggested Readings

1. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press
2. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG
3. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
4. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore.
5. Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn.& Pub. Govt. Press, Bangalore
6. Bisht D.S., *Apiculture*, ICAR Publication.
7. Singh S., *Beekeeping in India*, Indian council of Agricultural Research, NewDelhi.
8. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
9. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
10. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
11. Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, ICAR, (2006), DIPA, New Delhi, INDIA