



Centurion
UNIVERSITY

School of Applied Sciences

Centurion University of Technology & Management

M.Sc. (Botany) syllabus

(Two years programme)

2017

M.Sc. Botany
(Two year programme)
Course Structure-2017

Semester-I

Sl. No	Code	Subject Name	L-T-P	Credits
1	MSBO1101	Microbiology	3-1-0	4
2	MSBO1102	Plant Diversity	3-1-0	4
3	MSBO1103	Cell Biology	3-1-0	4
4	MSBO1104	Plant Ecology	3-1-0	4
5	MSBO1105	Botany Laboratory-I (Practical pertaining to theory)	0-0-6	4
6		Skill I	0-0-3	4
		Total		24

Semester-II

Sl. No	Code	Subject Name	L-T-P	Credits
1	MSBO1201	Genetics and Molecular Biology	3-1-0	4
2	MSBO1202	Plant Physiology, Metabolism, and Biochemistry	3-1-0	4
3	MSBO1203	Biostatistics and Instrumentation	3-1-0	4
4	MSBO1204	Environmental Pollution and Management	3-1-0	4
5	MSBO1205	Botany Laboratory-I I (Practical pertaining to theory)	0-0-6	4
6		Skill II	0-0-3	4
		Total		24

Skill Elective Subjects

Sl. No	Code	Subject Name	L-T-P	Credits
1	MSLS1001	Bio-fertilizer	0-0-3	4
2	MSLS1002	Tools and Techniques in Biosciences	0-0-3	4
3	MSLS1003	Phytochemistry and Pharmacogony	0-0-3	4
4	MSLS1004	Apiculture	0-0-3	4
5	MSLS1005	Medical Diagnostics	0-0-3	4

Semester-III

Sl. No	Code	Subject Name	L-T-P	Credits
1	MSBO2301	Systematics and Pathology	3-1-0	4
2	MSBO2302	Natural Resource Management and Utilization	3-1-0	4
3	MSBO2303	Embryology and Anatomy	3-1-0	4
4	MSBO2304	Techniques of Tissue Culture	3-1-0	4
5	MSBO2305	Botany Laboratory-III (Practical pertaining to theory)	0-0-6	4
6	MSRM5101	Introduction to Research	2-0-0	2
7	MSBP2301	Scientific visit	0-0-3	2
		Total		24

Semester-IV

Sl. No	Code	Subject Name	L-T-P	Credits
1	MSBO2401	Plant Biotechnology and Bioinformatics	3-1-0	4
2	MSBO2402	Eco toxicology & Waste Management	3-1-0	4
3	MSBO2403	Microbial Technology & Physiology	3-1-0	4
4	MSBP2401	Project/Dissertation	0-0-6	8
5	MSBS2401	Seminar	0-0-3	4
		Total		24

First Semester
MSBO1101 Microbiology

Code	Course Title	Course Type	Credits	L-T-P
MSBO1101	Microbiology	Theory	4	3-1-0

Module-I (17Hrs)

Features of Bergy's manual for classification of microbes, Whittakar's five kingdom concept, Isolation, culture and maintenance of microorganisms, Microbial growth, continuous culture, Factors influencing growth of microbes, Role of microbes in agriculture and industry.

Module-II (17Hrs)

General features of Archaea & Eubacteria Structure, Nutrition and Reproduction of Eubacteria, Genetic recombination in bacteria (Transformation, Conjugation and Transduction), General features and recombination in bacteria (Transformation, Conjugation and Transduction), General features and pathogenicity of mycoplasma, Rickettsia and Spirochetes

Cyanobacteria: Classification, cell structure, nutrition, reproduction, cellular differentiation, heterocyst and its function. Economic importance of cyanobacteria,

Module-III (18Hrs)

Virus: General characteristics and classification of viruses, nature, morphology and chemistry of virus, transmission of virus, virus-vector relationship, replication of Bacteriophage

Plant virus- TMV, structure, transmission, pathogenicity and replication

Animal viruses - HIV, structure, transmission, pathogenicity and replication

Treatment and prevention by anti-virals and vaccine.

Viroids and Prions.

Microbial toxins: types, mode of actions and pathogenicity.

Bacterial toxins, Fungal toxins: Algal toxins

Text Books:

Prescott, L. M., Harley, J. P. and Klen, D. A. (1999). Microbiology, 7th Ed., McGraw-Hill, New York.

Pelczar, Jr., M. J., Chan E.C.S. and Krieg, N. R. (2005). Microbiology, 5th Ed, Tata McGraw-Hill, New Delhi.

Alexopoulos, C. J., Mims, C. W. and Blackwell, M. (1996). Introductory Mycology, John Wiley, New York.

Kumar, H. D. (1988). Introductory Phycology. East-West Press, New Delhi.

Maloy, S. R., Cronan, J. E. Jr. and Freifelder, D. (2008). Microbial Genetics, 2nd Ed. Norosa, New Delhi.

Reference Books

Mehrotra, R. S. and Aneja, R. S. (1998). An Introduction to Mycology, New Age International, New Delhi

MSBO1102 Plant Diversity

Code	Course Title	Course Type	Credits	L-T-P
MSBO1102	Plant Diversity	Theory	4	3-1-0

Module-I (17Hrs)

Algae: Marine, Freshwater and Terrestrial algae, Classification, Food reserve, Pigment and Thallus organization

Life cycles, salient features and reproduction in Prochlorophyta, Chlorophyta, Bacillariophyta, Xanthophyta, Dinophyta, Phaeophyta and Rhodophyta.

Algal biomass production and utilization, algal blooms and their environmental impacts

Seaweed cultivation and utilization

Module-II (18Hrs)

Bryophyta: Morphology, structure, reproduction and life history. Distribution, classification, general account of Marchantiales, Jungermaniales, Anthoceratales, Sphagnales, Funariales and Polytrichales. Ecological importance.

Pteridophyta: Morphology, anatomy and reproduction; classification; evolution of stele; heterospory and origin of seed habit. General account of Psilopsida, Lycopsida; Sphenopsida and Pteropsida.

Module-III (17Hrs)

Gymnosperms: General characteristic feature of Gymnosperms, Classification of Gymnosperms and their distribution in India. General account of Cycadales, Coniferales, Ephedrales, and Gnetales.

Text Books:

Maloy, S. R., Cronan, J. E. Jr. and Freifelder, D. (2008). Microbial Genetics, 2nd Ed. Norosa, New Delhi.

Bhatnagar, S. P. and Moitra, A. (1996). Gymnosperms. New Age International, New Delhi.

Parihar, N. S. (1991). Bryophyta. Central Book Depot, Allahabad.

Reference Books

Parihar, N. S. (1991). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

Chamberlin, C. J. (1935). Gymnosperms: Structure and Evolution. Dover Publications, New York.

MSBO1103 Cell Biology

Code	Course Title	Course Type	Credits	L-T-P
MSBO1103	Cell Biology	Theory	4	3-1-0

Module-I (18Hrs)

Structural organization and function of intracellular organelles:

Structural organization of the plant cell, structure and functions of cell wall, plasma membrane; ion carriers, channels and pumps; receptors. Chloroplast, mitochondria, peroxisome, endoplasmic reticulum, ribosome, lysosome, vacuole, nuclear pore and nucleolus. Cell shape and motility: cytoskeleton, organization and role of microtubules and microfilaments, implications in flagellar and other movements.

Cell division, cell cycle and cell signaling:

Cell cycle: mitosis, meiosis, DNA synthesis in cell cycle, regulation of cell cycle: role of cyclins and cyclin-dependent kinases; cytokinesis and cell plate formation; cell surface receptors, G-protein coupled receptors, signal transduction pathways, secondary messengers, regulation of signaling pathways.

Module-II (17Hrs)

Structure and organization of eukaryotic chromosomes:

Chromatin and chromosome, heterochromatin and euchromatin, special types of chromosomes, karyotype, chromosome banding, sex chromosomes, sex determination in plants, dosage compensation, B-chromosomes, Packing of DNA, Nucleosome. Nuclear DNA content, C-value paradox, satellite DNA, cot-curve, unique and repetitive DNA.

Module-III (17Hrs)

Co-evolution, Origin of new genes and proteins; molecular evolution and polymorphism; Molecular tools in phylogeny. Compensation, B-chromosomes, Packing of DNA, Nucleosome. Nuclear DNA content, C-value paradox, satellite DNA, cot-curve, unique and repetitive DNA

Plasmodesmata: Structure, role in movement of molecules & macromolecules, comparison with gap junctions.

Plant Vacuole: Tonoplast membrane, ATPases, transporters as storage organelle

Chloroplast: Structure, genome organization, gene expression, RNA editing, nucleo-chloroplastic interaction.

Mitochondria: Structure, genome organization, Biogenesis.

Text Books:

Buchachanan, B. B., Grisse, W. and Jones, R. L. J., (2000). Biochemistry and molecular biology of plants. American Society of plant physiologists, Rockville, USA

Cooper G. M. (1997). The Cell: A molecular approach. ASM Press, Washington, D. C., USA.

Malacinski, G. M and Feidfelder, D (1998). Essentials of Molecular Biology, 3rd Ed. Jones and Bartel, London.

Reference Books

Lewine, B. (2004) Gene VIII, Person-Prentice Hall, London.

MSBO1104 Plant Ecology

Code	Course Title	Course Type	Credits	L-T-P
MSBO1104	Plant Ecology	Theory	4	3-1-0

Module-1 (17Hrs)

Ecosystem organization:

Biotic components, abiotic substances, trophic level, food chain, food web, Aquatic ecosystems, Marine ecosystems, Wetland ecosystems, Grassland ecosystems, Forest ecosystems. Ecological adaptations, Plant adaptation (morphological and anatomical)

Module- II (17Hrs)

Ecosystem function: Energy flow in the ecosystem, Primary production (methods of measurement), decomposition, energy dynamics (trophic organization, energy flow pathways, ecological efficiencies, Energy dynamics, concept of energy subsidy, universal energy flow, , Ecological pyramids, Bio-geo-chemical cycles, The Gaia hypothesis, Geo-chemical cycles (Hydrological cycles, gaseous cycles, sedimentary cycles).

Module-III (18Hrs)

Population Ecology: Population interactions (population density, natality, mortality, population age structure, carrying capacity, Community ecology: Ecological communities and ecosystems, structural analysis of communities, inter- and intra-specific competitions, Mutualism and commensalism, predation, parasitism, amensalism, competition and coexistence, Habitat and ecological niche.

Ecological regulation: System studies, Chemical transformations, Biochemical transformations, ecological succession, Mechanism of ecological succession and characters of succession, Process of succession, climax concept, Hydrosere, xerosere, ecological biodiversity.

Text Books:

Panigrahi, A. K. and Alaka Sahu (2012): Text book on Environmental Studies. Giribala Publishing House, Berhampur.

Gomez, K. A. and Gomez, A. A. ((1984).Statistical Procedures for Agricultural Research, 2nd Ed. John Weley, New York.

Kormondy, E. J. (1996). Concepts of Ecology, Prentice-Hall India, New Delhi.

Odum, E. P. (1971). Fundamentals of Ecology, Saundas, Philadelphia, USA.

Misra, B. N. and Misra, M. K. (1998). Introductory Practical Biostatistics, Nayaprokash, kolkata.

Smith, R. L. (1996). Ecology and Field Biology. Harper Collins, New York.

Reference Book

Subrahmanyam, N. S. and Sambamurty, A. V. S. S. (2000).Ecology. Narosa, New Delhi.

MSBO1105 Botany Laboratory-I

Code	Course Title	Course Type	Credits	L-T-P
MSBO1105	Botany Laboratory-I	Practice	4	0-0-6

1. General idea on instruments used in microbiology laboratory.
2. Preparation and sterilization of media (Nutrient Agar, Nutrient Broth, Czapeck-Dox), Plating Tubing, slanting of media.
3. Gram staining and acid-fast staining of bacteria.
4. Isolation of bacteria in pure culture.
5. Study of commonly occurring cyanobacteria.
6. Measurement of length/breadth/diameter of microbial cell/spore using ocular and stage micrometer.
7. Study of micro and macro algae in the field and in the laboratory (preparation of temporary & permanent materials and identification).
8. Study of morphology and reproductive structures of algae belonging to different classes through permanent microscopic preparations and preserved specimens.
9. Study of temporary & permanent preparation for microscope observation of external and internal features of vegetative and reproductive structure of important genera of Bryophytes.

10. Study of temporary and permanent preparation of vegetative and reproductive structure of Pteridophytes.
11. Study of temporary and permanent preparation of vegetative and reproductive structure of Gymnosperms.
12. Squashing techniques for study of mitosis and meiosis in onion root tip and flower bud. Use of camera lucida to study chromosomes & calculating the magnification.
13. To find out mitotic index of dividing cells of *Allium cepa* root tips.
14. Comparative karyotypic analysis of two species of a genus.
15. Separation of DNA by gel electrophoresis.
16. Biodiversity measurement by different indices
17. Characterization & behavior of B-Chromosome using maize or any other appropriate material.

Second Semester

MSBO1201 Genetics and Molecular Biology

Code	Course Title	Course Type	Credits	L-T-P
MSBO1201	Genetics and Molecular Biology	Theory	4	3-1-0

Module-I (17Hrs)

Genetics: mendelism and deviation of mendelian ratios, epistasis, linkage and crossing over, sex-linked inheritance, three point test cross and chromosome mapping, extra chromosomal inheritance.

Cytogenetic: structural chromosomal aberrations: duplication, deficiency, inversion and translocations heterozygotes; numerical chromosome aberrations: aneuploids: trisomics and monosomics; euploids: autopolyploids, allopolyploids, role polyploidy in speciation with reference to *triticum* and *brassica*.

Molecular cytogenetics: nuclear dna content, c-value paradox, cot curve & its significance.

Restriction mapping concept & techniques

Module-II (18Hrs)

Molecular Biology: Prokaryotic and eukaryotic DNA replication: DNA polymerases, replisome, replicon, primase, telomerase.

RNA transcription: mRNA, tRNA, rRNA, siRNA, miRNA, RNAi, RNA polymerases, RNA-processing, RNA splicing, spliceosome, RNA editing. Genetic code.

Protein translation, inhibitors of replication, transcription and translation, post-translational modifications, protein targeting.

Regulation of gene expression in prokaryotes and eukaryotes: role of chromatin in regulating gene expression and gene silencing.

Gene fine structure, cis-trans test; *in situ* hybridization concept and techniques, physical mapping of genes on chromosomes, FISH and GISH.

Module-III (17Hrs)

Mutagenesis, DNA damage and repair: Spontaneous and induced mutations, physical and chemical mutagens, molecular basis of mutations, transposable elements in prokaryotes and eukaryotes, mutations induced by transposons, site directed mutagenesis, DNA damage and repair mechanisms. Environmental mutagenesis and genetic toxicology.

Text Books & Reference Book:

Lewin, B. (2004). Gene VIII. Person-Prentice Hall, London.

Pierce, B. A. (2006). Genetics: A Conceptual Approach. W. H. Freeman, New York.

MSBO1202 Plant Physiology, Metabolism and Biochemistry

Code	Course Title	Course Type	Credits	L-T-P
MSBO1202	Plant Physiology, Metabolism, and Biochemistry	Theory	4	3-1-0

Module-I (18Hrs)

Membrane transport and translocation of water and solutes: Plant water relation, mechanism of water transport through xylem, phloem loading and unloading, passive and active solute transport, membrane transport proteins.

Photosynthesis: Light harvesting complex, structure and chemistry, Photolysis of water and Hill Reaction, Photo-phosphorylation, CO₂-fixation, C₃ and C₄ and CAM pathways,

Module-II (17Hrs)

Respiration and lipid metabolism: Glycolysis, Fermentation, TCA cycle, pentose phosphate path ways, mitochondrial electron transport and ATP synthesis, alternate oxidase, photo respiratory pathway.

Lipid metabolism: fatty acid biosynthesis, synthesis of membrane lipids, storage lipids and their catabolism.

Nitrogen fixation & Metabolism: Biological nitrogen fixation, asymbiotic and symbiotic nitrogen fixation nodule formation, nod and *nif* genes their regulation and function, mechanism of nitrate uptake and reduction, ammonium transport and assimilation.

Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, freezing and heat stress, oxidative stress.

Metabolism: reactive oxygen species (ROS), antioxidants, antioxidant enzymes: catalase, peroxidases, superoxide dismutase, glutathione transferase, glutathione reductase, *Halliwell-Asada cycle*.

Physiology of aging and senescence, influence of hormones and environmental factors on senescence. Programmed cell death.

Plant growth regulator & Elicitors: Physiological effect & mechanism of action of auxin, gibberellin, cytokinin, ethylene, abscisic acid, jasmonic acid & salicylic acid, hormone receptor, signal transduction & gene expression

Module-III (17Hrs)

Basics of Biochemistry: Structure of atoms, molecules, chemical bonds, stabilising interactions (Van der Waals, electrostatic, hydrogen bonding and hydrophobic interactions).

Principle of biophysical chemistry and bioenergetics: pH, buffer, reaction kinetics, thermodynamics, colligative properties. Coupled reactions, group transfer, biological energy transfer.

Biomolecules: Composition, structure, and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Confirmation and stability of proteins (Ramachandra plot, secondary, tertiary and quaternary structure, domains, motif, and folds). Confirmation and stability of nucleic acids (A-, B-, Z- DNA, t-RNA, mi RNA), phenols, terpenes.

Plant enzymes and Coenzymes: Nomenclature and classification of enzymes and coenzymes: Distribution of enzymes in plant, structure and function of Isoenzymes. Enzyme kinetics, mechanism of enzyme action and its regulation. Factors affecting enzyme action.

Antioxidants: structure and functions of ascorbic acid, glutathione, tocopherol, carotenoids etc.

Text books:

Buchachnanan, B. B., Grissem, W. and Jones, R. L. J., (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Rockville, USA.

Reference Book

Devlin, R. N. and Witham, F. H. (1983). Plant Physiology. CBS Publishers, Delhi.

MSBO1203 Biostatics & Instrumentation

Code	Course Title	Course Type	Credits	L-T-P
MSBO1203	Biostatics and Instrumentation	Theory	4	3-1-0

Module-I

(17Hrs)

Statistical Methods: Sampling methods, sampling distribution, measures of central tendency and dispersion

Probability distribution: normal, binominal and poisson distribution. Sample homogeneity and heterogeneity analysis by binomial and poisson distribution

Module-II

(17Hrs)

Biostatistics: Frequency distribution, cumulative and relative frequency. Measurement of central tendency and dispersion, mean, median and mode, mean deviations, variance and standard deviation, coefficient of variation, errors. Analysis of variance (ANOVA). Comparison of means: Students 't' test and paired 't' test. Chi-square

(X^2) test, 2 x 2 contingency table and association analysis as applied to biological experimental data. Simple correlation and linear regression analysis.

Module-III

(17Hrs)

Principle of Operation and Instrumentation of Light, Fluorescence and Electron Microscopes
 Ultraviolet-visible absorption spectroscopy: Principle, Instrumentation and application,
 Fluorescence spectrophotometry: Principle, Instrumentation and application
 Radioisotope techniques: Nature of radioactivity, isotopes in biochemistry,
 Principles of electrochemical techniques: Electrochemical cells and reactions, potentiometry and voltametry, the pH electrode
 Centrifugation techniques: Basic principles of sedimentation, Types of centrifuges, Types of rotors, Methods in preparatory ultracentrifugation (differential and density gradient centrifugation).
 Chromatographic techniques: Principles of chromatography (Adsorption and Partition chromatography), Planar chromatography (Paper and Thin-layer chromatography),

Text Book:

Boyer, R. (2004). Modern Experimental Biochemistry, 3rd Ed. Perason Educational Publication, Singapore.
 Buchachnanan, B. B., Grisse, W. and Jones, R. L. J., (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant physiologists, Rockville, USA

Reference Book

Goodwin, T. W. and Mercer, E. I. (1985). Introduction to Plant Biochemistry, 2nd ed. Pergamon, Oxford.
 Mathews, C. K., Van Holde, K. E. and Ahern, K. G. (2000). Biochemistry, Addison-Wesley Publishing Company, San Francisco, USA.

MSBO1204 Environmental Pollution & Management

Code	Course Title	Course Type	Credits	L-T-P
MSBO1204	Environmental Pollution and Management	Theory	4	3-1-0

Module-I

(17Hrs)

Pollution: Air pollution, water pollution, soil pollution, noise pollution, and radiation pollution. Sources of Pollution- Both natural and manmade, pollutants.
 Concept of bio magnification of pesticides and heavy metals in the ecosystem, eutrophication

Module-II

(17Hrs)

Effects of pollution: Global warming and climate change, Greenhouse gases (GHG), Ozone layer depletion, PAN, smog, acid rain etc. Carbon and GHG management, United Nations Framework Convention on Climate Change (UNFCCC), the Monteral Protocol., COP. Kyotoprotocol, & carbon foot printing

Module-III

(17Hrs)

Pollution Control:
 Control measures of air pollution 1, treatment of waste water: sewage and sewage treatment, solid waste management and recycling, municipal solid waste management, composting,
 Management of toxic waste: Characteristics, toxic chemicals, hospital waste and their management, treatment of hazardous waste
 Legal acts & Pollution: legal remedies against pollution, Environmental Protection Act (EPA), water act, air act, environment act, Pollution Control Board, Disaster and disaster management.
 Environmental education and awareness, environmental audit, environmental management, environmental crisis, environmental ethics.

Text Books:

Panigrahi, A. K. and Alaka Sahu (2012): Text book on Environmental Studies. Giribala Publishing House, Berhampur.
 Das, R. C., Baral. J. K., Sahu, N. C. and Misra, M. K. (1998). The Environmental Divide: The Dilemma of Developing Countries. A. P. H. Publication, New Delhi.

Kumar, H. D. and S.P. Adhikary (2006). A Text Book on Environmental Engineering. India Tech Publishing, New Delhi.

Reference Book

Hill, M. K. (1997). Understanding Environmental Pollution. Cambridge University Press, UK.

Mason, C. F. (1991). Biology of Freshwater Pollution. Longman, New York

MSBO1205 Botany Laboratory-II

Code	Course Title	Course Type	Credits	L-T-P
MSBO1205	Botany Laboratory-I I	Practice	4	0-0-6

1. Measurement of Dispersion, Standard Deviation (SD), Standard Error of Mean, (SEM), variance of the given sample.
2. Statistical Analysis of Biological Samples & study of Test of Significance by T-test, X² test & F-test
3. To find out the relationship between Ecological variable by Correlation & Regression method
4. Induction of Polyploidy by Colchine
5. Isolation of Plant DNA & Quantification of Extracted DNA by spectrophotometric method
6. To measure amount of soluble total protein & carbohydrate content of Plant samples.
7. To estimate dissolved oxygen content, chloride, CO₂, acidity & alkalinity content in eutrophic & oligotrophic
8. Water samples by Winkler's method.
9. Effect of time & enzyme concentration on the rate of enzyme reaction
10. To determine the ratio between chl a / chl b in c3 & c4 plant.
11. Study of principles of spectrophotometer & verification of Beer-Lambert's law.
12. Effect of substrate concentration on activity of any enzyme & determination of Km value.
13. (Acid phosphatase, Peroxidase, Catalase)
14. To estimate chl content in SO₂ fumigated & un-fumigated leaves
15. Extraction of pigments from leaves & preparation of absorption spectra for chlorophyll & carotenoids.
16. Preparation of standard curve for quantification of protein, carbohydrate & reducing sugar.
17. Isolation & quantification of extracted DNA by spectro-photometric method.

Skill elective subjects

MSLS1001 Bio fertilizer

Code	Course Title	Course Type	Credits	L-T-P
MSLS1001	Bio-fertilizer	Practice	4	0-0-3

Experiments:

1. Isolation of rhizobium or azotobacter from plant root nodules.
2. Identification of soil cyanobacteria from different soil samples.
3. Culture of cyanobacteria-
 - A. Growth media
 - B. Media preparation & strater culture
 - C. Sterilization of medium in autoclave
 - D. Prepare slants & plates
 - E. Inoculation & growth of cyanobacteria
4. Cyanobacteria inoculation to plants
5. Coating the seeds with cyanobacteria extract & observing its growth basically in monocots
6. Field application of cyanobacteria
7. To list five plants which can be used as green manure.
8. To study different types of mycorrhizal association.
9. Isolation of vam
10. Methods of bio compost
11. Methods of vermicomposting
12. Field application of vermicompost

MSLS1002 Tools & Techniques in Biosciences

Code	Course Title	Course Type	Credits	L-T-P
MSLS1002	Tools and Techniques in Biosciences	Practice	4	0-0-3

Experiments:

1. General principle & application of colorimeter, spectrophotometer,
2. General principle & application ultracentrifuge, flame photometer beers & lambart law
3. Microbial techniques: media preparation, sterilization, inoculation & growth monitoring.
4. Microbial assay
5. Microbial identification
6. Separation techniques such as chromatography
7. Principle types & applicants. Electrophoresis,
8. Principles types & application page, sds-page.
9. Histological techniques: principle of tissue fixation, microtomy, staining, mounting.
10. Molecular biology techniques: southern hybridization, western hybridization, Northern hybridization (any one of these)
11. Dna sequencing, polymerase chain reaction (pcr)
12. Principles types agarose gel & gel electrophoresis

MSLS1003 Phytochemistry & Pharmacognosy

Code	Course Title	Course Type	Credits	L-T-P
MSLS1003	Phytochemistry and Pharmacogonsy	Practice	4	0-0-3

Experiments:

1. Preparation of plant profile of some locally available medicinal plants, suchas tulsi,neem,&turmericetc
2. Herbarium preparation
3. Extraction of phytochemicals such as alkaloid,terepenoids,& sapogennin
4. Separation by tlc&hplc.
5. Characterization byuv spectrophotometer

MSLS1004 Apiculture

Code	Course Title	Course Type	Credits	L-T-P
MSLS1004	Apiculture	Practice	4	0-0-3

Experiments:

1. Study of characteristics of honey bee (queen,worker& drawn bee).
2. Study of selection of bee species.
3. Study of social organization of bee colony.
4. Study & observation of techniques of bee keeping.
5. Demonstration of bee keeping equipment.
6. Observation of pollination & work of bee.
7. Study of artificial bee rearing.
8. Study of methods of extraction of honey.
9. Scientific visit to apiculture industry/institute
10. Submission of a small project as per course.

Text books:

- singh s., beekeeping in india, indian council of agricultural research, newdelhi

Reference books:

- prost, p. J. (1962). Apiculture.oxford and ibh, new delhi.
- bishtd.s., apiculture, icar publication.

MSLS1005 Medical Diagnostics

Code	Course Title	Course Type	Credits	L-T-P
MSLS1005	Medical Diagnostics	Practice	4	0-0-3

Experiments:

1. Preparation of blood smear.
2. Study of d.l.c (differential leucocyte count) using leishman's stain.
3. Platelet count using haemocytometer.
4. Determination of abo blood group
5. Estimation of haemoglobin using sahli's haemoglobinometer
6. Preparation of haemin and haemochromogen crystals
7. Recording of blood pressure using a sphygmomanometer.
8. Estimation of blood glucose using glucometer/kit
9. Estimation of sugar in urine.
10. Estimation of protein using kit.
11. Estimation of lipid using kit.
12. Study & preparation of e.s.r
13. Preparation of tlc for amino acid/other molecules
14. Basic methods to diagnosis aids, tuberculosis & hepatitis.
15. Study of various medical imaging techniques
16. Estimation of hcg in urine.

Text books:

- Park, k. (2007), preventive and social medicine, b.b. publishers

Reference books:

- Park, k. (2007), preventive and social medicine, b.b. publishers
- Godkarp.b. and godkard.p. Textbook of medical laboratory technology, ii edition, bhalani publishing house
- Cheesbrough m., a laboratory manual for rural tropical hospitals, a basis for training courses
- Guyton a.c. and hall j.e. textbook of medical physiology, saunders
- Robbins and cortan, pathologic basis of disease, viii edition, saunders

THIRD SEMESTER

MSBO2301 Systematics & Pathology

Code	Course Title	Course Type	Credits	L-T-P
MSBO2301	Systematics and Pathology	Theory	4	3-1-0

Module-I (18Hrs)

Taxonomic Structure: Taxonomic hierarchy; Concept of species, genus and family, Plant Nomenclature: Salient features of International Code of Botanical Nomenclature (ICBN), Major rules: priority, effective and valid publications and author citation. Type concept, Taxonomic Tools: Field and Herbarium techniques; Floras and Botanic Gardens, Computer and Taxonomy.

Systems of Angiosperm Classification: Artificial, natural and phylogenetic systems, relative merits and demerits of major systems of classification (Bentham and Hooker, Engler and Prantle, Hutchinson and Takhtajan).

Module-II (17Hrs)

Angiosperm Families: Floral structure and phylogenetic relationship among the taxa under the following orders: Liliflorales, Scitaminae, Orchidales, Ranales, Rosales, Tubiflorae, Malvales, Asterales and Rubiales
Taxonomic Evidences: Morphology, anatomy, palynology, embryology, cytology, phytochemistry and serology.

Module-III (17Hrs)

Classification of fungi, structure and reproduction of Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Degeneration of sexuality in fungi, nutrition in fungi, heterothallism, heterokaryosism
Plant Pathology: Disease symptoms, modes of infection and dissemination, disease resistance, defense mechanisms in plants and control of plant diseases, host-parasite relationship, fungal toxins and their mode of action.

Text Books:

Davis, P. H. and Heywood, V. H. (1973). Principles of Angiosperms Taxonomy. Robert E. Kreiger, New york.
Panigrahi, AK and Sahu Alaka (2002): Glossary of Economically important plants. New Central Book Agency, Calcutta.
Heywood, V. H. and Moore, D. M. (1984). Current Concepts in Plant Taxonomy. Academic press, London.
Solbrig, O. T. (1970). Principles and Methods Plant Biosystematics. MacMillan, London.
Stace, C. A. (1989). Plant taxonomy and Biosystematics. Edward Arnold, London.
Takhtajan, A. L. (1997). Diversity and Classification of Flowering Plants. Columbia University Press, NY.
WOODLAND, D. W. (1991). Contemporary plant systematics. Prentice-hall, new jersey, usa.

Reference Book

Fundamental of plant pathology by n.gravichandran, phi learning private ltd.
Plant pathology by pdsharma, alpha science publication.

MSBO2302 Natural Resources, Management and Utilization

Code	Course Title	Course Type	Credits	L-T-P
MSBO2302	Natural Resource Management and Utilization	Theory	4	3-1-0

Module-I

(17Hrs)

Natural resources and management: Conservation of natural resources, Non-renewable energy resources, Alternative sources of energy, new concepts for alternative energy. Renewable energy resources: Water resources, soil resources, Soil conservation and management. Water resources and conservation: rain water harvesting, water shed management, uses of water, Forest as a renewable resource, deforestation, afforestation, conservation, social forestry, wild-life conservation

Module-II

(17Hrs)

World Centres of Primary Diversity of Domesticated Plants: Basic concepts, origin of agriculture and plant introduction. Origin, evolution, botany, cultivation and uses of (i) Food crops, (ii) fibre crops, (iii) medicinal and aromatic plants, and (iv) vegetable and oil-yielding crops with special reference to local plants. Plants, plant parts and plant products used in homeopathy medicines, Plants, plant parts and plant products used in ayurvedic medicines, Important timber-yielding plants, Important poisonous plants of India.
Concept of Phytogeography: Climate and Vegetation pattern of the World; Endemism, Floristic regions of India; vegetational pattern of India.

Module-III

(17Hrs)

In situ conservation: International efforts and Indian initiatives; protected areas in India – Sanctuaries, national parks, biosphere reserves, wetlands and mangroves for conservation of wild biodiversity.

Module IV

Ex situ conservation: Principles and practices; botanical gardens, field gene banks, seed banks, cryobanks, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR). Principles of conservation; extinction; environmental status of plants based on IUCN (Now World Conservation Union). Salient features of Biodiversity Act and rules. Ethnobotany and forest products: basic principles and scope, uses of medicinal and aromatic plants, cultivation and trade of medicinal plants, important firewood and timber yielding plants, collection, trade and management of non-wood forest products, plants used as avenue trees for shade, and aesthetics, plants used in sericulture and biodiesel production, joint forest management and stakeholders responsibility.

Text books:

Panigrahi, A. K. and Alaka Sahu (2012): Text book on Environmental Studies. Giribala Publishing House, Berhampur.

Conway, G. and Barbier, E. (1994). Plants, Genes and Agriculture. Jones and Bartlett, Boston, USA.

Heywood, V. H. and Wyse Jackson, P. S. (1991). Tropical Botanical Gardens, Their role in Conservation and Development. Academic press, San Diego, USA.

Reference Books

Kothari, A. (1997). Understanding Biodiversity: Life sustainability and Equity. Orient Longman, New York.

Negi, S. S. (1993). Biodiversity and its Conservation in India. Indus Publishing Company, New Delhi.

MSBO2303 Embryology and Plant Anatomy

Code	Course Title	Course Type	Credits	L-T-P
MSBO2303	Embryology and Anatomy	Theory	4	3-1-0

Module-I

(17Hrs)

Male and female gametophyte: Structure of anthers, microsporogenesis, role of tapetum, pollen development and gene expression; male sterility, sperm dimorphism and hybrid seed production, pollen germination, pollen tube growth and guidance, pollen storage, pollen allergy, pollen embryos. Female gametophyte: Ovule development, megasporogenesis; organization of the embryo sac, structure of the embryo sac cell.

Module-II

(17Hrs)

Pollination, Pollen-pistil interaction and fertilization: Floral characteristics, pollination mechanisms and vectors, breeding system; commercial considerations, structure of the pistil, pollen stigma interactions, sporophytic and gametophytic self-incompatibility (cytological, biochemical and molecular aspects), double fertilization *in vitro* fertili:

Seed development and fruit ripening: Endosperm development during early, maturation and desiccation stages, embryogenesis, ultra-structure; cell lineages during late embryo development; storage proteins of endosperm and embryo; polyembryony, apomixis; embryo culture, dynamics of fruit growth and ripening; Latent life-dormancy; Importance and types of dormancy, seed dormancy, overcoming seed dormancy, bud dormancy.

Module-III

(17Hrs)

Plant Anatomy:

Tissue and tissue system: Meristematic tissue, distribution of mechanical tissues, apical meristem, Anomalous secondary growth (adaptive and non-adaptive), Root-shoot transition, shoot-root development, leaf development and phylotaxy, transition to flowering.

Text books for reading:

Bewley, J. D. and Black, M. (1994). Seed: physiology of Development and Germination. Plenum, New York.

Bhojwani, S. S. and Bhatnagar, S. P. (2008). The Embryology of Angiosperms. Vikas Publishing House, New Delhi.

Reference Book

Raghavan, V (1997). Molecular Embryology of Flowering Plant. Cambridge University Press, Cambridge.

Raghavan, V. (1999). Developmental Biology of Flowering Plants. Springer-Verlag, New York.

MSBO2304 Techniques of Tissue Culture

Code	Course Title	Course Type	Credits	L-T-P
MSBO2304	Techniques of Tissue Culture	Theory	4	3-1-0

Module-I

(17Hrs)

History, scope, concept of cellular differentiation and totipotency, the culture environment, plant cell culture media, sterilization techniques, clonal propagation using nodal and shoot tip cultures

Organogenesis: Callus mediated plant regeneration, adventitious organogenesis, somatic embryogenesis, induction and maintenance of callus culture, production and analysis of somaclonal variants, cell suspension culture for production of secondary metabolites, biotransformation.

Embryo culture and embryo rescue, protoplast isolation, culture and plant regeneration, somatic hybridization: protoplast fusion, selection of heterokaryotic fusion products, analysis of hybrids, somatic hybrids and cybrids

for crop improvement, artificial seeds, cryopreservation, slow growth and DNA banking for germ plasm conservation.

Module-II

(18Hrs)

Vector-mediated Gene Transfer to plants: Molecular basis of crown gall and hairy root diseases, features of Ti and Ri plasmids, mechanism of T-DNA transfer, role of virulence genes, hairy root cultures as source of pharmaceuticals, vectors based on PTi&PRi, binary and co-integrate vectors, optimized protocols for Agrobacterium-mediated genetic transformation, transgenic dicots and monocots. Plant viruses as vectors.

Module-III

(17Hrs)

Direct gene transfer to plants and in plant transformation: Rationale for monocot transformation, physical methods (particle bombardment/ micro projectile / biolistic, electroporation, microinjection, liposome mediated, silicon carbide fibers), chemical methods (PEG - mediated, calcium phosphate co-precipitation), transgenic monocots and dicots via direct gene transfer, in plant transformation. Integration and fate of transgene, precision of transgene integration by site-specific

Text Books

Bhowjani S. S and Bhatnagar S.P. 2000. The Embryology of Angiosperm (4th revised & enlarged edition)-Vikas Publishing House.

Shivana, K.R & Sawhney V.K(ed), 1997. Pollen Biotechnology for crop production & improvement

The Plant cell. Special curve on Reproduction Biology of Plqants, vol.5(10),1993. The American Society of Plant physiologist, Rockville, Maryland, USA

Reference Book

Shivana, K.R & Joshi B.M. 1985. The angiosperm pollen: Structure & Function, Willey Eastern Ltd., Newyo

MSBO2305 Botany Laboratory-III

Code	Course Title	Course Type	Credits	L-T-P
MSBO2305	Botany Laboratory-III	Practice	4	0-0-6

1. Study of living shoots apices by dissection using Hydrilla plants
2. Study of cytological zonation in the shoot apical meristem (SAM) by preparing L. S of Coleus shoot apex and making permanent slides with double stained procedures
3. Study of wood anatomy through temporary and permanent slides
4. Study of different types of ovules, endosperm, and embryos in permanent slide preparation
5. Study of in vitro pollen morphology, germination and pollen tube growth
6. Collection, description and identification of locally available wild angiospermic taxa pertaining to nomenclaturally important category
7. Preparation of a short list of ten most important sources of firewood and timber of the locality. Study of common pathogens of plant (fungi, bacteria, mycoplasma) with anatomy of infected parts.
8. Collection, identification and preservation of common plant diseased materials of the locality.
9. Temporary and permanent preparation for microscopic observation of external features, internal structures and reproductive structures of important genera belonging to fungi.
10. Study of microsporogenesis & gametogenesis in sections of anthers.
11. Test for Pollen viability using stains & in vitro germination. Pollen germination using hanging drop & siting drop culture, suspension culture, & surface culture.
12. Study of seed dormancy & methods to break dormancy.
13. Preparation of tissue culture media.
14. Techniques of surface sterilization and plant regeneration via organ culture.
15. Production of synthetic seeds.

MSBP2301 SCIENTIFIC VISIT (0+0+3) Cridits-2

INTRODUCTION TO RESEARCH (2+0+0) Cridits-2

Fourth Semester

MSBO2401 Plant Biotechnology and Bioinformatics

Code	Course Title	Course Type	Credits	L-T-P
MSBO2401	Plant Biotechnology and Bioinformatics	Theory	4	3-1-0

Module-I (17Hrs)

Recombinant DNA technology; Genomic DNA & plasmid DNA isolation and purification, construction of recombinant DNA and expression cassettes, Transformation (mobilization of vectors into competent bacteria), selection and analysis of recombinant clones, Chromosome walking, Chromosome jumping, genomic DNA and cDNA libraries. Antisense RNA technology: Regulatory RNA (micro RNA), Antisense RNA, construction of antisense vectors, analysis of antisense clones, applications of antisense technology. Gene silencing: causes (DNA methylation, homology-dependent suppression by antisense gene), strategies for avoiding gene silencing, methods of inducing gene silencing and its application. Diagnostics in agriculture and molecular breeding: ELISA.

Module-II (18Hrs)

Plant genomics: Introduction to plant genomics, functional genomics, transcriptomics and proteomics, comparative genomics, organelle genomes (Mitochondria and Chloroplast).

Studying genomes: shotgun approach, clone coting approach, chromosome walking and jumping. Polymerase chain reaction (PCR), RT-PCR.

Analysis of genome through application of DNA fingerprinting techniques: RFLP, RAPD, AFLP, SSR, DNA micro array. Physical maps, expressed sequence tags (ESTs).

Module-III (17Hrs)

Bioinformatics: DNA sequence databases & protein sequence databases, phylogenetics and bioinformatics, analysis packages & data mining, applications of bioinformatics in genome sequencing, agriculture, medicine and molecular evolution

Text books:

Glick, B. R. and Pasternak (2003). Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, Washington, D. C., USA.

Kyte, L. and Kleyn, J. (1996). Plants From Test Tube to: an Introduction to Micro propagation, 3rd Ed. Timber press, Portland, USA.

Reference Book

Pollard, W. J. and Walker (1990). Plant Cell and Tissue Culture Vol VI. Humana press Clifton, USA.

MSBO2402 Eco Toxicology and Waste Treatment

Code	Course Title	Course Type	Credits	L-T-P
MSBO2402	Eco toxicology & Waste Management	Theory	4	3-1-0

Module-I:

(17Hrs)

concept of toxicity; mechanism of toxicant action; dose, effect and response; analysis of response curves; statistical doses of toxicants; Selection of test batteries, media, apparatus and facilities, liquid media and sediment toxicity assessment, microtox acute toxicity test; toxicity test by luminescent and fluorescent bacteria, algae, zooplankton and macrophytes, microplate toxicity test,

Module-II

(18Hrs)

Bioaccumulation: Concept and measurement, food chain and lipophilicity approach, quantitative structure activity relationship, kinetics of uptake and retention, factors affecting bioaccumulation.

Bioaccumulation of metals: Biodegradation of organic pollutants: Microbial processes for degradation; measurement of biodegradability; aerobic and anaerobic degradation of carbohydrates, proteins and lipids, aliphatic hydrocarbons, aromatic hydrocarbons

Module-III**(17Hrs)**

Solid waste processing technology: Sources and types of solid wastes, components of solid waste management, sanitary landfilling-biological processes, leachate control and treatment, site management

Waste water treatment and disposal: eutrophication-causes, effects and control wastewater treatment processes, biological treatment of wastewater oxidation, nitrification, de-nitrification, role of biofilm, biological removal of phosphorus, secondary treatment systems-conventional and high rate bio filters, rotating biological contactors, activated sludge, nutrient removal through biomass production.

Text Books:

Solid waste management by George & Frank

Municipal Solid waste management by R.V. Ramachandran

Reference Book

Fundamental of Ecotoxicology-C.Newmann

MSBO2403 Microbial Technology & Physiology

Code	Course Title	Course Type	Credits	L-T-P
MSBO2403	Microbial Technology & Physiology	Theory	4	3-1-0

Module-I**(17Hrs)**

Microbial techniques: Culture media, different types of culture media, pure culture methods (isolation and maintenance), enrichment culture, microbial staining methods (Gram staining, Acid fast staining, capsule and endospore staining, staining of yeast cells), isolation of DNA.

Microbial enzymes: Sources of enzymes, selection of microorganisms, mechanism of enzyme biosynthesis, large scale production and enzyme recovery, enzyme assay, enzyme production by microbes (α -amylase, Invertases, Cellulases, Proteases and Lipases), enzyme immobilization.

Module-II**(18Hrs)**

Bacterial photosynthesis (photosynthetic pigments and their location in the cell, anoxygenic photosynthesis, oxygenic photosynthesis, CO₂ fixation), microbial nutrition (photoautotrophs, photoorganotrophs, chemolithotrophs and chemo-organotrophs), nitrate reduction and de-nitrification process, sulphate reduction, fermentation, fermentation diversity (acid, alcohol, mixed acid fermentation), energetics and redox considerations of fermentation.

Module-III**(17Hrs)**

Growth kinetics: Concept and mathematics of exponential growth, growth cycle, measurement of microbial growth (direct and indirect measurement methods), Batch, Fedbatch and continuous culture system, monitoring microbial growth in culture, factors affecting microbial growth Synchronous and asynchronous culture, continuous culture and chemostat principle.

Text books:

Prescott, L. M., Harley, J. P. and Klen, D. A. (1999). Microbiology, 7th Ed., McGraw-Hill, New York.

Pelczar, Jr., M. J., Chan E.C.S. and Krieg, N. R. (2005). Microbiology, 5th Ed, Tata McGraw-Hill, New Delhi.

Reference Book

Agrios, G. N. (2005). Plant Pathology, 5th Ed, Elsevier Academic press, USA.

SEMINAR

Code	Course Title	Course Type	Credits	L-T-P
MSBS2401	Seminar	Seminar	4	0-0-3

PROJECT

Code	Course Title	Course Type	Credits	L-T-P
MSBP2401	Project/Dissertation	Project	8	0-0-6